Imperial Bureau of Plant Genetics

(For Crops other than Herbage)

Plant Breeding Abstracts

Vol. V, No. 4

School of Agriculture

Cambridge

England

July 1st, 1935

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Note.—Initialled abstracts are written by the following:

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* General studies, see also individual crops.

Plant Breeding Abstracts.

Vol. V, No. 4.

Part I. British Empire

STATISTICS 519

839. HENDRICKS, W. A. 519.24
The use of " differential regression " in analysis of variance.
J. Agric. Sci. 1935 : **25** : 258–63.

A further elaboration of the method of analysis of covariance in dealing with experimental data is proposed, and illustrated in two cases. Briefly, the method involves the separate calculation of regression coefficients for lots of data subject to different treatments, and it is claimed that the results of statistical analysis may be misleading when this is not done, owing to the occurrence of " differential regression." The test for the significance of differences among the various regressions is not however given, although it has been published. J.W.

840. 519.241
FISHER, R. A. and YATES, F. 631.421
The 6 × 6 Latin squares.
Proc. Cam. Phil. Soc. 1934 : **30** : 492–507.

Since the correct application of the Latin Square design in field experimentation depends on the ability to select a square at random from all possible squares of a given size, the mathematical problem of their enumeration is of importance. This problem has only hitherto been solved completely for squares up to size 5 × 5. In this paper the enumeration is carried out for 6 × 6 squares by means of an intramutation process, and gives 9408 as the number of " reduced " squares, thus correcting an earlier estimate of 8192. It is shewn how the aggregate of 6 × 6 squares may be derived from only 17 examples, which are given in the paper. For details of the procedure of selecting a square at random see a paper by Yates (" Plant Breeding Abstracts," Vol. IV, Abst. 297). J.W.

GENETICS 575

841. 575.1
HALDANE, J. B. S. 576.12
Genetics since 1910.
Nature, Lond. 1935 : **135** : 726–29.

A summarized statement of the numerous achievements and solved and unsolved problems of genetics and its applications to plants and animals (including man) and also to evolution and the origin of species.

842. 575.1:576.312
GAINES, E. F. 575.1:631.521.6
The results of recent research in genetics.
Proc. 5th Pacif. Sci. Congr. Canada 1933 : **4** : 2627–29.

Our knowledge of genetics has probably doubled since 1925. The predominating subject of research in recent years has been the relation of cytology to genetics, with disease resistance next in importance. The practical results of work on the latter topic have helped to popularize the science, especially because of the production and widespread cultivation of disease-resistant cereals.

843. 575.172.1.061
575.172.1–181
SINNOTT, E. W. and DUNN, L. C. 581.14:575.17
The effect of genes on the development of size and form.
Biol. Rev. 1935: **10** : 123–51.
An article directing attention to the importance in genetic research of not neglecting the study of the relationship between the genes and development in animals or plants. The work that has been done on the genic control of size and shape, the problem of the size of parts, genic balance, and correlated growth rates is reviewed.
The necessity is emphasised for increasing our knowledge of the developmental processes in material that has been genetically analysed, as a preliminary to the formulation of generalized principles.
There is an extensive bibliography.

844. WRIGHT, S. 575.22:519.24
The analysis of variance and the correlations between relatives with respect to deviations from an optimum.
J. Genet. 1935 : **30** : 243–56.
The contributions to variance due to (1) additive gene effects, (2) dominance deviations, and (3) epistatic deviations are analysed, first assuming no environmental complications. Later the effect of the environment is also considered as (a) environmental effects and (b) non-additive joint-effects of heredity and environment. In the case of complete dominance, formulae are derived which apply to epistatic relations in general, leading to formulae for the correlation between parent and offspring and between offspring and offspring.
It is shewn that when the mean of a measurable character corresponds with the optimum in a given population, the parent-offspring and fraternal correlations in adaptive value are approximately the squares of the corresponding correlations with respect to the character itself, whether environmental complications are considered or not.

845. 575.41:519.24
WRIGHT, S. 576.12
Evolution in populations in approximate equilibrium.
J. Genet. 1935 : **30** : 257–66.
Assuming no epistasis, the processes of evolution in populations in which the selective values of different grades of a character depend on the (squared) deviation of the latter from an optimum are studied mathematically, in the cases of no dominance and of complete dominance. The nature of the evolutionary processes under the conditions described may be visualized by treating the population at a given moment as located at a point in a multi-dimensional space defined by the set of gene frequencies pertaining to the plus or dominant members of the gene pairs affecting the character, adaptive values being measured on the ordinates.
A picture is given of the positions of relatively stable equilibrium as " peaks " with saddles between. The effect of selection alone is to force the population to the top of a peak, but if and when this is reached, no further progress can be made unless other factors come into play. The author considers that the normal process of evolution in such populations consists of the shifting of the population from one peak to another under the influence of various factors.

CYTOLOGY 576.3

846. GATES, R. R. 576.312
Nuclear structure and chromosomes.
Nature, Lond. 1935 : **135** : 729–32.
A review of progress since the King's accession. By 1910 the chromosomes were generally considered the physical basis of Mendelian heredity. Lines of research developed since then include chromosome mutation, polyploidy and amphidiploidy, linkage and chromosome mapping, natural and induced structural changes in chromosomes, secondary pairing, chromosome morphology internal and external, the nature of the nucleolus, micro-dissection, and recently the significance of the bands on the giant chromosomes in salivary glands of insects.

847. 581.143.26.03

Vernalization.

Agric. Bull. Bermuda 1935 : **14** (3) : 21–23.

The principles of vernalization for those in Bermuda who are interested.

848. PURVIS, O. N. 581.143.26.03

An analysis of the influence of temperature during germination on the subsequent development of certain winter cereals and its relation to the effect of length of day.

Ann. Bot., Lond. 1934 : **48** : 919–55.

The length of time required to reach earing in cereal plants receiving different experimental treatments was investigated. In winter rye one series was grown in normal long day (16 hrs.) and subjected to temperatures of 1°C and 18°C respectively immediately after germination, a second series was grown in short day (10 hrs.) with similar temperature treatments and further series with nitrogen and potash deficiencies were included. In the long-day series cold germination reduced the length of time required for earing and flowering, which effect was not observed in the short-day plants. Low temperature in the long-day treatment also reduced the rate of tillering, an effect again not evident in the short-day plants.

Examinations of the ear initials shewed that the point at which flowering ridges begin to be laid down is earliest in the low temperature treatments under long-day and latest with nitrogen starvation and high germination temperature. Reduced day length retarded flower differentiation in the plants germinated at 1°C, whilst at 18°C the plants grown in short days formed a greater number of floral ridges and so had a higher potential grain-yielding capacity than the plants in long day; nevertheless the spikes died within the leaf sheaths in the absence of long-day treatment, but when this was later applied it induced normal earing, with the production of very large ears with increased numbers of grain. The plants grown in long days with low temperature shewed a rapid increase in growth and differentiation of the spike after the fourth week, whereas the other series continued their slow rate of growth without any sign of such an increase. After germination at the higher temperature, the short day induced the greater growth in length of the spike and floral differentiation while in spring rye the temperature of germination had no effect whatever on flowering, though this was inhibited by reduction in length of day.

No effect of nitrogen deficiency either in retarding growth and differentiation in long day or in removing the inhibiting effect of short days was observed. Neither sugar content, nitrogen content nor the carbon-nitrogen ratio were affected in such a way by the different treatments as to constitute a cause of the different flowering reactions.

The observations on the spike primordia indicate that a minimal number of leaves must be formed before the differentiation of flower initials can occur. Under short-day conditions this is always about twenty-two, irrespective of variety and temperature, whilst under long-day conditions the minimal number is less for plants grown at low than at high temperatures, namely 12 for the former and 22–25 for the latter. This combines with the more rapid elongation of the spike to accelerate the floral differentiation and induce a behaviour analogous to that of spring varieties, where the minimal number is only 7. The effect of the greater minimal number of leaves required before " ripeness to flower " is attained in short days, is partially counterbalanced by the higher rate of differentiation in these plants, particularly in those grown at low temperatures. The increased rate of floral differentiation in short days also affords an explanation of the photoperiodic after-effect observed by Rasumov in short-day plants like millet. However, in long-day plants like oats or barley the floral differentiation is almost independent of day length, only the later stages being hastened by long day. All spring cereals are also of this type. On the other hand winter rye behaves as a long-day plant only when germinated at low temperatures. When germinated at 18°C the floral differentiation shews the typical short-day behaviour, being promoted by short day, though stem elongation and further stages of floral development still retain the long-day reaction. Thus the effect of chilling in winter cereals sown in the spring is to reduce the minimal number of leaves required for flower

initiation and enable the plants to attain the condition of "ripeness to flower" at an earlier date while long days still prevail. It is in this way that the phenomena of vernalization are interpreted.
These results illustrate the importance of examining the time of formation of the flower primordia rather than the time of emergence of the inflorescence in studies of this kind.

849. BELL, G. D. H. 581.143.26.03:633.1
Preliminary experiments on vernalization.
J. Agric. Sci. 1935 : 25 : 245–57.
Seeds of various spring and winter cereals were treated for 7, 14 and 21 days at 3°C. and others for 7 and 21 days at 1°C. before sowing in dibbed plots. Germination was accelerated in nearly all varieties, most of all in the spring varieties ; the only variety shewing no acceleration was Joss IV winter wheat.
A further series was treated also for 21 days at 3°C. and 1°C. and grown in a greenhouse in such a way that no marked fall in temperature was ever experienced. This series shewed still more pronounced differences in time of germination.
At the age of 6–7 weeks all barley plants were more luxuriant in growth than the controls and in those varieties where the controls were procumbent the treated plants were more erect, especially in the greenhouse. In wheat however only one variety, Cambridge Rivett, shewed any effect at this stage. All oat varieties were more luxuriant and Grey Winter was also more erect.
The growing points were examined and proved to be more advanced both in spring and winter varieties.
An acceleration in earing was observed in the winter varieties of barley and wheat but none in the oat varieties. The difference in time of earing resulting from the treatment was much more pronounced in the plants grown in the greenhouse in all varieties with the exception of Grey Winter and Bountiful oats ; and one variety of spring barley, Swanneck, shewed a slight acceleration in the greenhouse, though none in the field. Furthermore the control plants grown in the field all came into ear before the ones in the greenhouse, thus indicating that the low temperatures experienced in the early period in the field had effected a partial vernalization. In the winter wheat varieties the treated plants in the field also eared before those in the glass-house, suggesting that the period of treatment was insufficient. There are indications that treatments of 14 days were more efficient than 7 days and that 3°C. was better than 1°C.
A late sowing experiment was made with winter varieties of wheat, barley and Grey Winter oats, which were treated for 14 days at 3°C. and sown on 28th April. No acceleration was observed in the early development but the treated plants of the barleys Bocumer, a variety referred to as " Wintergerste " and *Hordeum spontaneum* eared irregularly in mid-July whilst the controls almost or entirely failed to ear. Cambridge Rivett wheat behaved similarly, Joss IV failed to ear in both treated and control and Yeoman II wheat and Grey Winter oats eared simultaneously in treated and control.
Special attention is called to the fact that many of the varieties giving the greatest response in the early stages shewed no acceleration in earing and conversely the winter varieties with their maximum difference in earing date shewed little or no early response. It is suggested that even when treatment fails to hasten ear emergence it may result in other stimulation effects such as enhanced yield, or disease resistance. It is further pointed out that some of the earlier maturing varieties were hastened more than certain others of much later date of earing. The type of response is thus a varietal character.

850. FORSTER, H. C. 581.143.26.03:633.11(94)
Response of English and Australian wheats to length of day and temperature.
J. Aust. Inst. Agric. Sci. 1935 : 1 : 27–28.
Observations were made on the time of earing of an Australian and English spring wheat and an English winter wheat when sown at 7–10 day intervals throughout the year. One lot was sown under normal daylight and the other under a constant illumination of 16 hours daily. In the autumn sowings the plants in the longer day headed 38 days earlier than the normal

plants, the difference becoming less pronounced in the later sowings. That temperature also acted in the direction of hastening earing was shewn by the earlier heading of the plants sown in summer, which eared 60 days earlier than those sown in winter. Plants of the winter variety sown after September failed to come into ear but this behaviour was not shewn by the spring varieties.

The results shewed that germination and the period from heading to maturity were influenced by temperature alone, while the rosette and jointing stages were affected both by temperature and length of day. Soil temperature of over 15°C. prevented heading in winter but not in spring varieties.

The method of vernalization is therefore thought to be inapplicable to the Australian wheats, all of which are spring forms but by making use of the behaviour here described it is possible to grow two and sometimes three generations in a year.

Many apparently uniform varieties have proved markedly heterozygous in their response to the above treatments.

PLANT DISEASES 632

851. 632.451.2:576.16:575.12:633.13

POPP, W. and HANNA, W. F. 633.13–2.451.2:575.11

Studies on the physiology of the oat smuts.

Sci. Agric. 1935 : **15** : 424–34.

Oat seedlings inoculated with single monosporidial cultures of *Ustilago avenae* and *U. levis* produced no smutted heads, whereas plants inoculated with two monosporidial cultures of opposite sex of *U. avenae* or of *U. levis* or with a culture of *U. avenae* and one of opposite sex of *U. levis* did so. The hybrid-chlamydospores of the latter cross, which is probably quite frequent under natural conditions, would be mistaken for *U. avenae.*

Infection with *U. avenae* or *U. avenae* x *U. levis* gave echinulate chlamydospores, while plants infected with *U. levis* contained smooth chlamydospores and proof of the dominance of the factor for echinulate spores over that for smooth spores was obtained by back-crossing cultures of the F_1 hybrid (*U. avenae* x *U. levis*) with *U. avenae* and *U. levis.*

As regards the inheritance of the type of smutted head produced, i.e. covered or loose, the conclusions differed somewhat from those previously published (Cf. " Plant Breeding Abstracts," Vol. I, Abst. 261). It now appears that environment may markedly modify the inherent capacity of the parasite to affect its host in a particular way ; though a higher percentage of heads of the loose smut type do actually seem to be produced by cultures bearing the factor for echinulate spores than by cultures with the smooth spore factor.

Spore germination, sporidial growth and segregation for sex and cultural characters are also discussed. (Cf. also " Plant Breeding Abstracts," Vol. I, Abst. 344.)

852. 632.452:575.242

CRAIGIE, J. H. 632.452:577.8:575.12

Recent advances in the biology of plant rusts.

Proc. 5th Pacif. Sci. Congr. Canada 1933 : **4** : 3221–27.

The first mutations found in rust fungi were two for colour of urediniospores, described by Newton and Johnston in 1927. Others, for physiological behaviour, pathogenicity and colour have since been described. Work on the sexual behaviour of *Puccinia helianthi* and *P. graminis* has shewn that the formation of aecia after fusion of haploid pustules of opposite sign is accompanied by fusion between pycniospores and non-septate hyphae protruding through the ostioles of the pycnia. Following this discovery crosses between various races and forms of *P. graminis* have been made, and have shewn that most of them are heterozygous in respect of pathogenicity. Crosses of different coloured forms have shewn the presence of complementary colour factors.

The occurrence of mutations and heterothallism will, if inheritance of colour and pathogenicity be conclusively shewn to be Mendelian, place inheritance in the rust fungi on the same footing as in the higher plants.

853. 633:575(42)
633:575

BELL, G. D. H.

Crops and plant breeding.

J.R. Agric. Soc. 1934 : **95** : 169–95.

A survey of the present situation with respect to sugar beet shews that increased yield of sugar is necessary to improve the efficiency of the industry. Improved varieties were formerly produced by continuous mass selection, but better and more uniform results have been obtained by pure line selection followed by hybridization. Recent work has shewn a negative correlation between sugar content and content of nitrates and chlorides, a fact which can be utilized in selection. The farmer himself, however, could greatly increase his yields, using the varieties at present available, by improved methods of cultivation.

A brief account of the present knowledge of virus diseases is given.

In potato breeding an agronomically valuable blight-resistant variety has yet to be produced. Advances have been made, however, by the use of South American *Solanum* species in crosses, and the devising of a method for artificially inoculating seedlings by Salaman and O'Connor (see " Plant Breeding Abstracts," Vol. III, Abst. 237) has facilitated the determination of susceptibility. Even less progress has been made in attempting to control virus disease by breeding resistant strains. More success has been achieved in devising methods of raising virus-free stock, and rules of cultivation to keep virus disease at a minimum have been suggested. Variety trials carried out by the National Institute of Agricultural Botany should assist growers in the selection of the most remunerative varieties to be grown.

The multiplicity of varieties, many of them mere names, is a bugbear to-day. The work of the National Institute of Agricultural Botany on potatoes and of the Cereal Synonym Committee should help growers in this respect.

854. DICKSON, J. G. 633–2.4

The nature of immunity in plants.

Proc. 5th Pacif. Sci. Cong. Canada 1933 : **4** : 3211–19.

Reaction between host and parasite is primarily a property of the cell, and is influenced by genetical factors and physiological factors ; through the latter the environment plays its part. Virulence cannot be determined except in relation to disease development, and neither it nor resistance are absolute characters. The mode of inheritance of resistance and immunity is inevitably complex, and little is known on the subject. Resistance may be classified according to the factors determining it, viz. (1) external structures of the host plant (e.g. thickness of membrane), (2) cellular membranes of the host (e.g. chemical nature of middle lamellae) and (3) the general physiological or chemical reactions of the cell protoplasm of both host and parasite (e.g. specific substances in host protoplasm, or absence of suitable foods for the parasite or the " hypersensitive reaction ").

855. 633–2.4–1.521.6:575
633–2.8–1.521.6:575

Breeding and selection for immunity against disease (e.g., in potato, cotton, tropical crops).

Rep. Third Imp. Mycol. Conf. 1934 : 24–26.

A brief report is given of a discussion on the work that has been done in breeding for cotton resistant to black arm (*Bacterium malvacearum*) in Uganda, to wilt (*Fusarium vasinfectum* var. *aegyptiacum*) in Egypt, and for potatoes resistant to wart disease at Rothamsted and to late blight (*Phytophthora infestans*) at Cambridge.

The discussion also dealt with research on the banana and breeding for resistance to Panama disease (*Fusarium* [*oxysporum*] *cubense*), investigations on virus resistance, the problem of the existence of biotypes of pathogenic fungi attacking potatoes and the value of laboratory and field tests in plant breeding work. (Cf. " Plant Breeding Abstracts," Vol. IV, Abst. 597 ; Vol. V, Abst. 34.)

856. WENHOLZ, H. 633–2.4–1.521.6:575
Breeding for disease resistance.
Proc. 5th Pacif. Sci. Congr. Canada 1933 : **4** : 2579–83.
In stressing the need for close co-operation between pathologist, geneticist and agronomist, the author points out the value of a practical view-point, and cites in illustration several cases where a plant which might have been rejected by the pathologist as only moderately resistant under artificial conditions has proved most valuable in the field. Selection and, where necessary, introduction of new varieties are methods which should not be ignored, and often have given results in the past without the help of plant breeders. Strict quarantine regulations are necessary, however, and these should apply even to pathologists' material. In determining disease resistance, the effect of the environment should not be forgotten.
In some districts of New South Wales, wheat resistant to flag smut, stem rust, leaf rust, bunt, loose smut and *Septoria* leaf spot is desired. The *vulgare* wheat Hope appears to be resistant to most of these diseases, and good results are also expected to be obtained by breeding from certain emmer-*vulgare* and *durum-vulgare* crosses.

857. 633.0015(68)
633:575(68)
The Sub-stations of the Division of Plant Industry. Their objects and achievements.
Fmg. S. Afr. 1935 : 10 : 110–13.
Brief notes on the activities of various stations with regard to the improvement of cereals, legumes, potatoes, tobacco, hops, vines, citrus fruits, pineapples and other fruits.

CEREALS 633.1

858. AAMODT, O. S. 633.1:575(71)
Breeding cereal varieties for northern regions.
Proc. 5th Pacif. Sci. Congr. Canada 1933 : **4** : 1729–39.
The problem of crop improvement is a relative one, closely related to agricultural practice and economic factors. Studies of the factors which influence yield and quality have been carried out at the University of Alberta often under artificial conditions. Advances have been made by testing winter hardiness by refrigeration, drought resistance in a wind or " chinook " machine, and disease resistance by artificial epidemics produced by composite cultures of inoculum containing all the physiological forms known to exist in the region in which the variety is to be grown. Baking quality in wheat and starch content in barley are tested by growing on poor soil and straw strength on low, wet, fertile soil.
In stressing the need for coordination in agricultural research, the author outlines the methods used in the University of Alberta for testing large hybrid populations in portions for different characters.

859. 633.1–2.4–1.521.6:575
AAMODT, O. S. 632.4:576.16:633.1
The relation between physiologic forms of phytopathogenic fungi and the problem of breeding for resistance to disease.
Proc. 5th Pacif. Sci. Congr. Canada 1933 : **4** : 2615–25.
The occurrence of numerous physiological forms of phytopathogenic fungi has led to the opinion that the breeding of disease resistant plants might become so complicated as to be almost impossible. The discovery of these forms, however, does not necessarily intensify the problem, but increases the cost owing to the many factors to be considered.
It is reasonable to suppose that the virulence of new forms will not exceed that of the forms already known and this supposition is supported by observation. Immunity to a number of forms is often governed by one genetic factor, e.g. in the wheat Kanred the author found resistance to 16 different physiological forms of *Puccinia graminis tritici* to be controlled by a single factor. Moreover, there appears to be no insuperable genetic obstacle to the breeding of varieties resistant to all the known physiological forms of a fungus. On the other hand in the

case of less specialized parasites, such as the foot rots, the breeding of resistant varieties is more difficult, owing to the lack of definite and characteristic reactions of the host, and to the wide range of hosts available to the parasites. Another point to be considered is that a variety susceptible to a given physiological form in the seedling stage is often immune in the field; seedling immunity, however, normally implies immunity when mature.
In conclusion the author outlines the factors to be considered in a programme of crop improvement, and emphasizes the value of subjecting the segregating hybrid material to artificial epidemics comprising all the known forms likely to be encountered.

860. 633.1–2.452–1.521.6(94)
WATERHOUSE, W. L. 632.452:576.16:633.1(94)
Some aspects of cereal rust problems in Australia.
Proc. 5th Pacif. Sci. Congr. Canada 1933 : **4** : 3169–76.
Cereal rusts, especially stem rusts, sometimes do very serious damage in Australia. The aecidial stage of *Puccinia graminis* on barberry has not been found in nature, and the evidence suggests that the uredospore stage is present on living plants all the year round.
On wheat *P. graminis tritici* occurs in seven different forms, one of which, Form 34, to which no Australian wheat is fully resistant, has latterly superseded the other six, namely 43, 44, 45, 46, 54 and 55. Of the five forms of *P. graminis avenae* found, Forms 1 and/or 2 (the two are difficult to distinguish in practice) preponderate largely over Forms 3, 6, and 7. *P. triticina* is represented only by Form 26, which in Australia is separable into two distinct types according to reaction with the wheat Thew. Only one form of *P. anomala* has been found, closely resembling Mains' Form 1, but differing from it in reaction with certain barley varieties not usually included in the differential set. Nothing can be said at present about the specialization in *P. coronata* or *P. dispersa*.

WHEAT 633.11

861. FRANKEL, O. H. 633.11 " Cross 7 "
" Cross 7 " wheat, a new combination of high yield and baking-quality.
Bull. Dep. Sci. Industr. Res. 1934 : No. 46 : Pp. 18.
Details are given of the behaviour in comparative trials of the new variety " Cross 7," a selection from the cross White Fife x Solid straw Tuscan. The aim has been to produce a wheat as high yielding as Tuscan but with a better baking quality.
The results shew that, at least on the lighter soils, the yield of the new variety is higher than Tuscan, that it is distinctly more resistant to lodging and straw-break and that in resistance to rusts it shewed the same reaction as Tuscan. Cross 7, on the whole has given a markedly superior flour and a 2·2 per cent additional flour extraction.
Tests by Pelshenke's fermentation method and Engledow's distensometer shewed that Cross 7 though decidedly superior to Tuscan is slightly inferior to White Fife.
The main defect of Cross 7, its smaller size of grain may be compensated by increased tillering in some seasons or by a higher rate of seeding.

862. FRANKEL, O. H. 633.11 " Cross 7 "
" Cross 7 ", a new combination of high yield and baking-quality in wheat.
N.Z. J. Sci. Tech. 1934 : **16** : 169–84.
Issued as the bulletin reviewed in preceding Abstract.

863. 633.11:575.127.2:576.312.35
THOMPSON, W. P., ARNASON, T. J. and LOVE, R. M.
Some factors in the different chromosome sets of common wheat.
Canad. J. Res. 1935 : **12** : 335–45.
The inheritance of some twenty-one characters was studied in lines segregating from crosses between n = 21 (*vulgare*) and n = 14 (emmer) wheats, the varieties used being Marquis (*vulgare*),

Iumillo (*durum*), Vernal (*dicoccum*), and Black Persian (*persicum*). If a *vulgare* character appears in the n = 14 lines, then the genes controlling it must occur in the two sets of chromosomes (A and B) which pair with the emmer sets; if not, it is probably in the other set (C.) In the *vulgare* x *durum* hybrids 7 out of 19 and in the *vulgare* x *dicoccum* 9 out of 21 *vulgare* characters occurred in a certain number of the 83 n = 14 families studied. Certain other characters were found in a near-*vulgare* condition in lines with $14_{II} + 1_{I}$, indicating that genes affecting them occur in the C set as well as in the primary 14 chromosomes. Details of the mode of inheritance of some of the characters are also given.

The results do not shew the concentration of the specific characters of *vulgare* in the odd C set of chromosomes, to be expected on the basis of the theory that *vulgare* arose from a cross between an *Aegilops* species and an emmer wheat. Thus it should not be impossible to obtain n = 21 plants with emmer characters, a conclusion which is supported by unpublished results obtained with n = 21 plants.

864. CARTER, L. M. 633.11:575.42:578.08

Methods of seed selection recommended for the improvement of wheat varieties.

J. Dep. Agric. S. Aust. 1935 : **38** : 1010–12.

A practical account of the procedure used in pedigree and mass selection written to interest wheat growers in plant breeding research and to encourage them ultimately to take part in the growing of improved strains.

865. AAMODT, O. S. and TORRIE, J. H. 633.11:581.48:578.081

A simple method for determining the relative weight per bushel of the grain from individual wheat plants.

Canad. J. Res. 1934 : **11** : 589–93.

In breeding for drought resistance the variation in size of grain from individual plants was so great that the usual measure of plumpness, weight per thousand grains, proved of little value. A new method for evaluating the weight per measured bushel of small samples was devised and was found to have a very high degree of association with an estimated degree of plumpness of grain.

Directions are given for determining plumpness of large and small numbers of samples respectively.

866. FAIRFIELD SMITH, H. 633.11–1.557:575.114.3

Reversion of selected strains of a wheat variety.

J. Coun. Sci. Industr. Res. Aust. 1935 : **8** : 37–41.

Statistical studies by the author on results published by the Nebraska Experiment Station shew that strains with markedly different yields, selected from Turkey Red wheat, gradually reverted until after 14 to 15 years their yields were all the same as that of the original variety. The data suggest that the selection of 5 to 40 best plants from each strain was unable to check the reversion and also that the reversion was not due to cross-pollination. Speculation as to the cause of this phenomenon is useless until more accurate evidence is available.

867. 633.11–1.557:575.148:575.22

MCMILLAN, J. R. A. 633.11–1.557:581.48

Predetermination as an influence on yield in wheat plants.

J. Coun. Sci. Industr. Res. Aust. 1935 : **8** : 1–7.

To estimate the influence of predetermination (non-genetic variations in form and size of seed) on yield in wheat, seeds from pure lines and the plants arising from them under uniform environmental conditions were studied. Significant correlations were found between a number of seed and mature plant characteristics, the most important being those between seed weight and yield and between early growth (height after 16 days) and yield, which together accounted for 24 per cent of the variance in yield (R = 0·49).

The results in general shew that predetermination causes a considerable amount of plant variation.

868. FISHER, E. A. 633.11:664.641.016
Flour quality : its nature and control.
Pamphl. Coun. Flour-Mill. Ind. 1935 : No. 3 : Pp. 58 (2nd Ed.).
The question of baking quality is treated throughout from the technical point of view in the second edition of this pamphlet, the text of which has been revised and enlarged by the extension and development of certain sections to bring them up to date.

869. FRANKEL, O. H. and DONALD, H. P. 633.11:664.641.016:575
Some critical observations on quality testing in wheat breeding.
Proc. World s Grain Exhib. and Conf. Canada 1933 : **2** : Pp. 8.
As the baking test fails to distinguish between inherent gluten quality and the effects of environment, tests were made by means of the distensometer and Pelshenke's fermentation method (representing the methods for the determination of gluten tenacity on unfermented doughs and of tests on fermented doughs).
The tests were compared over a three year period and with regard to seasonal variation the most consistent results were obtained with the distensometer. Either method could be used in the case of the low quality wheats but for better quality wheats a shorter time is required for reliable results by the use of the distensometer. The distensometer also gave a clearer indication of small varietal differences.
In the selection of breeding lines, the use of these tests is mainly confined to the detection of the weak lines or further for the interpretation of the results of baking trials.
A table is given of a total of 882 varieties of wheat from different parts of the world shewing their quality as determined by one or both of the methods described for one to three seasons, as a preliminary to their use as parents in cross-breeding.

OATS 633.13

870. 633.13:575.127.2:575.061.634:576.312
PHILP, J. 633.13:575.061.634:576.356.5
Aberrant albinism in polyploid oats.
J. Genet. 1935 : **30** : 267–302.
One F_4 family from *Avena sativa gigantica* x *A. fatua* (see " Plant Breeding Abstracts," Vol. III, Abst. 560) consisted of 9 green plants and 61 albinos, the latter dying within a few weeks. Six greens (1:6 type) again gave excess of albinos over greens in F_5 and one (3:1 type) gave approximately 3 greens : 1 albino ; the other two greens were sterile. In F_6 the former F_5 greens again proved to be 1:6 type, while of the latter F_5 greens approximately one third bred true, about two-thirds were 3:1 type and a few were 1:6 type. Cytologically, 1:6 type greens were found to have 41 chromosomes (42–1), forming at meiosis $20_{II} + 1_I$, the univalent lagging and splitting at anaphase I and sometimes at anaphase II. Its distribution among the pollen grains was estimated and it was found to be included in 5–15 per cent. of the pollen grains, the percentage varying from plant to plant. Green 3:1 type plants had 40 somatic chromosomes, forming 20_{II} at meiosis. The albinos also have 40 somatic chromosomes. From this and other detailed evidence given, it is concluded that the odd chromosome of the 1:6 type greens carries a factor for chlorophyll production and in its absence the 40 chromosome plants are albinotic ; the production of albinotic sectors in 1:6 type green plants is ascribed to somatic mutations involving the loss of the odd chromosome.
The suggested explanation may be summarized briefly as follows : in the hexaploid parents there are three pairs of polymeric factors for chlorophyll production, $V_1\ V_1$, $V_2\ V_2$, $V_3\ V_3$. Assuming one parent to have $V_1\ V_1\ v_2\ v_2\ V_3\ V_3$ and the other $V_1\ V_1\ V_2\ V_2\ v_3\ v_3$ in the F_2 $V_1\ V_1\ v_2\ v_2\ v_3\ v_3$ plants could be obtained. By abnormal pairing (allosyndesis) in such a plant between V_1 and a v_2 chomosomes, forming a chain of four, followed by 3–1 disjunction, 41 chromosome green F_3 plants would be obtained, which by normal pairing would give approximately 1 green: 6 albinos, the exact ratio depending on the frequency of inclusion of the fragment in the pollen grains. By abnormal pairing, with crossing-over between V_1 and v_2 chromosomes, with loss of the odd chromosome, 40 chromosome green 3:1 type plants would be obtained.

The deficient chromosome was not the C-chromosome, for the plants lacking it were quite vigorous and had regular meiosis. The meiotic behaviour of the odd chromosome was similar to that of the C-chromosome in 41 chromosome plants, as was its effect on the pollen, but its effect on the zygote was much less. The results are discussed in connexion with the origin of fatuoid and other mutant forms. The importance of the C-chromosome in the evolution of the species is stressed and it is suggested that the complete linkage in a block of factors which it carries is due to suppression of crossing-over, associated with structural change, as in *Oenothera*.

MAIZE 633.15

871. 633.15:581.143.26.03
633.18:581.143.26.03
633.18–1.547.4

HAIGH, J. C.
Vernalization.
Trop. Agriculturist 1934 : **83** : 329–38.

Following the methods used by Russian workers on maize no shortening effect was observed. As no previous technique was available for the vernalization of rice a number of treatments were tried and significant differences were found, but too slight to be of practical value. Further modification of the treatment might, however, have greater effect. It is considered on general grounds that vernalization is unlikely to be of practical value in the tropics.
A note on flowering in rice is appended to the above article as the data therein collected offered a further opportunity to verify the fact that a pure line crop of rice requires, under normal conditions, 3–4 weeks to complete its flowering and also that a crop is " 50 per cent flowered " about 10 days after the first flower has appeared.

MILLETS AND SORGHUMS 633.17

872. 633.174:575.14
633.174:519.241.1:581.46

SHEN, T. H. and SWEN, C. I.
Studies on the method of kaoliang breeding in China. Part I : Effect of selfing.
Proc. 5th Pacif. Sci. Congr. Canada 1933 : **4** : 2585–93.

SHEN, T. H.
Studies on the method of kaoliang breeding in China. Part II : Method of kaoliang threshing and relation of the total weight of head to the weight of grain in kaoliang.
Proc. 5th Pacif. Sci. Congr. Canada 1933 : **4** : 2593–601.

PART I.
Natural crossing in kaoliang (*Andropogon sorghum*) is estimated at not more than 10 per cent ; selfing therefore should not cause any reduction in vigour.
Thirty-eight varieties and several types were grown, and their reaction to selfing tested by bagging and comparing the progeny with that of uncontrolled plants. Collectively, no significant difference was found in yield, height of plant, number of heads per plant, or weight of kernels, except, in the last case, such as was due to the inhibition of development by bagging. The only discernable effect of selfing was to isolate better or worse strains. Some strains reached a condition of homozygosity after two or three years, while others were still heterozygous after four.
PART II.
From measurements made during the work described in Part I, a very high correlation ($r = 0{\cdot}9+$) was found between weight of head, and weight of grain after threshing. The mean percentage of grain in the kaoliang heads was 78 per cent, and except in irrigated plants there was no significant deviation from it, nor did selfing have any effect on the percentage of grain or its coefficient of variability. With rare exceptions in the case of border line types, selection on a basis of total weight of head agreed with selection on a basis of weight of grain. In all cases the heads were cut off at their first node, stored for about a fortnight, and head and grain were weighed within 10–20 minutes of each other, to avoid variation in moisture content.
The type of box used for experimental threshing is described, the heads being beaten against a bamboo grating and the grains caught in a tin funnel leading to a drawer.

873. 633.174:581.162.5:581.46

RANGASWAMI AYYANGAR, G. N. PANDURANGA RAO, V.

Fertile pedicelled spikelets in sorghum.

Curr. Sci. 1935 : **3** : 433–35.

The discovery of grain-bearing pedicelled spikelets in three varieties of sorghum at the Millets Breeding Station, Coimbatore, is recorded. Though the seeds from pedicelled spikelets were smaller and lighter in weight than those in sessile spikelets, germination tests shewed no loss in viability.

The frequency and distribution of the anomaly and the behaviour of the pedicelled hermaphrodite or staminate flowers at anthesis are discussed ; and the possible bearing of the concurrent flowering of the hermaphrodites, whether pedicelled or sessile, upon the role played by a full sexual complement in the opening of flowers is suggested.

The possibility of using this discovery to breed for an entirely fertile ear combined with large grain size in sorghum is being explored.

874. 633.175:581.165.1:575.12

RAMGASWAMI AYYANGAR, G. N. and PANDURANGA RAO, V.

Bulbils in sorghum.

Curr. Sci. 1935 : **3** : 362–63.

In the second generation from crosses between double-seeded and single-seeded varieties of sorghum 8 plants out of 674 displayed tiny bulbils on the spikelets. The bulbils, of which there were 22 in all (the maximum in a head being 3) are regarded as resulting from the conversion of one of the grains into a leaf-like structure.

It is suggested that bulbil formation may be an indication of the prolificacy connoted by doubling and trebling of the grain or that it may represent some primitive tendency of some ancestors of sorghum in their original habitat.

RICE 633.18

875. 633.18:575(54.1)

Scientific report of the Rice Research Station, Bihar and Orissa, for the year ending the 31st March, 1933.

Bull. Dep. Agric. Bihar and Orissa 1934 : No. 4 : Pp. 69.

The progress of the work undertaken by the Rice Research Station and begun in 1932 is reviewed.

A study is being made of the course of anthesis in the rice flower, the effect of some meteorological factors on the biology of the flower and the percentage of cross–pollination in the crop.

An investigation has been begun on the botanical and agricultural characters of single plant cultures from which pure lines are being selected.

Genetical analyses are being made on the inheritance of a number of characters in the segregating lines. Spikelet colour, grain size and awn characters have been studied.

The various types of rices grown in the province are being surveyed and a comparative study is in progress on the form and structure of the root of various varieties grown under different conditions and including a comparison of the root systems of flood and drought-resistant varieties.

The causes of sterility are also being investigated. Crossing technique is being studied and crosses made between awned and awnless types. It is expected that cytological work will be begun in 1934.

876. 633.18:575(91)
633.18:575.11

COLEMAN-DOSCAS, A. E.

Rice experiments in Malaya 1933-1934. Selection, varietal and minor cultural trials.

Malay. Agric. J. 1935 : **23** : 10–40.

Details are given of the results of tests of selected strains and of variety trials in the various districts.

The appendix is devoted to the hybridization experiments in progress at Titi Serong 1933–34. In these, white colour of the grains behaved as a simple dominant to straw colour. Strong straw appeared to be recessive to weak straw but the segregation ratios indicate that these are not simple allelomorphic characters.

877. KADAM, B. S. 633.18:575.242.061.634
A virescent-white mutation in rice.
Curr. Sci. 1935 : 3 : 301–02.
This mutant, a seedling with white leaves which very gradually developed a greenish hue occurred in an early Kolamba strain, K.79. Fertility being normal, about 400 seedlings of the white mutant were raised and all were like the original mutant. They were inferior to K.79 in panicle length, number of tillers and in yield and were five days later in flowering. The slow growth of the virescent-whites which contained about 66 per cent of chlorophyll as compared with K.79 is attributed to the very slow rate of chlorophyll formation.
The mode of inheritance of the new type is being studied.

ROOTS AND TUBERS 633.4

878. MACDONALD, J. A. 633.42–2.411–1.521.6
Plant pathology.
Scot. J. Agric. 1935 : 18 : 164–67.
A note on two short experimental tests with commercial stocks of marrowstem kale, kohl rabi, thousand headed kale and turnips. The results support the prevailing impression that marrowstem kale is highly resistant to *Plasmodiophora brassicae*. Evidence of the possibility of marked differences in the resistance of various strains of marrowstem kale was also obtained.
The trials are to be continued.

FIBRES 633.5

879. 633.51:575(54.7)
Ann. Rep. Indian Cent. Cott. Comm. Bombay 1933–1934 : Pp. 152.
Frequent reference is made throughout the Report to the different activities in improving the cotton crop by breeding and selection. The more important are noted below.
Institute of Plant Industry, Indore. The work of the Institute includes a survey of the cottons of India but greater attention is paid to the more fundamental questions. Cytological work has indicated that an irradiated cotton seed has given a plant with more than the normal number of chromosomes. Various other hybrids are being submitted to cytological investigation and the genetics of lint length and ginning percentage studied.
Madras. The improvement of Uppam (*G. herbaceum*) by selection has not yielded satisfactory results and resort is being made to interspecific crosses. Attempts are also being made to select a strain to replace Nadam (*G. obtusifolium*), a perennial, by an annual.
Bombay. Two schemes involving breeding aim at the improvement of Broach in the Nerbudda-Mahi area and the replacement of Banilla (a cross between Bani and Comilla) in the Kandesh area.
Punjab. Several new strains, including a cross between N.T. 12 and Million Dollar, are under trial to replace the 4F (American) cotton which is subject to periodic failures.
Central Provinces. Verum 262 has spread widely but is subject to adverse weather ; it is being replaced by a strain *Late Verum* and V 434.
United Provinces. A further survey of the local cottons is being conducted.
Hyderabad. Selections are being made from the local Bani mainly to improve the ginning percentage.
Under the heading Seed Distribution Schemes a statement is given of the organizations employed for distributing the seed of the various strains which have passed beyond the experimental stage.
H.M.L.

880. 633.51:575.1
633.51:575.127.2:576.365.5
Chromosomes ; and the work of Professor Ruggles Gates.
Emp. Cott. Gr. Rev. 1935 : 12 : 95–102.
A paper on the growth of genetics with special reference to research on cotton in various countries. Special attention is drawn to Professor Ruggles Gates' present research on species hybridization in *Gossypium* from which it is hoped *inter alia* to obtain a useful and fertile species hybrid in which the chromosome number has been doubled.

881. 633.51:581.466:575.11

RAMANATHA AYYAR, V. and SANKARAN, R.

Petalody in cotton.

Indian J. Agric. Sci. 1934 : 4 : 938–42.

Two kinds of petalody were found : (1) wherein the stamens on the lower three-fourths of the staminal column were completely metamorphosed into petaloid structures, those at the top being only partially so and a few being normal ; (2) wherein many of the stamens on the lower half of the staminal column were transformed into petals, but were less distinct, smaller in size and paler in colour. The anthers at the top were whitish and contabescent, and produced no pollen.

An F_1 raised from seeds from the few bolls which were obtained when pollen from the first kind of flower was applied to stigmas of emasculated normal flowers consisted of all normal plants, while in F_2 a simple segregation into normal and petaloid on a 3 : 1 ratio was obtained. B.P.P.

882. 633.51–1.557–1.421
633.51.0014

CHRISTIDIS, B. G.

Intervarietal competition in yield trials with cotton.

J. Agric. Sci. 1935 : 25 : 231–37.

Nine cotton varieties were grown in three row plots in ten-fold replication, to test the effect of competition. The yield of seed cotton was determined, and a calculation made of the difference between the yield of the middle row and the mean of the two outside rows. On analysis, significant varietal differences were found to exist, the means ranging over 6 per cent of the height of the central row. Similar calculations for height of plants shewed no significant differences. It was concluded that the competitive value of a variety depends on that of the varieties with which it is grown in competition, and that competition may cause a definite bias in estimating the comparative yielding value of cotton varieties. J.W.

883. FAHMY, T. 633.51–2.484–1.521.6:575.11:575.42

Genetic basis of selection procedure with cotton wilt disease.

Bull. Minist. Agric. Egypt 1934 : No. 128 : Pp. 35.

In continuation of the author's previous work, (see " Plant Breeding Abstracts," Vol. II, Abst. 355), details are given of the results of tests made on the progenies of phenotypically immune, resistant and susceptible plants from a number of different crosses and from some strains of unknown genetical origin.

Two types of immunity are distinguished, one, fixed immunity shewn by plants and their progenies under all degrees and conditions of infection, and the other, shifting immunity when segregation continues to occur and a small percentage of resistant plants appear under extreme conditions of infection.

The importance of using a standard and optimum method of infection for a comparison of the behaviour of different types is stressed and of determining the precise degree of infection under normal field conditions, under which those plants with the shifting type of immunity might behave as true immunes.

A study of the segregation of resistant plants suggests the cumulative nature of the inheritance of resistance. Such plants are of no value in selection for immunity as segregation always occurs.

SUGAR PLANTS 633.6

884. KHANNA, K. L. 633.61:575(54.1)

Scientific report of the Sugarcane Research Station, Bihar and Orissa, Mushari, for the year ending the 31st March, 1933.

Bull. Dep. Agric. Bihar and Orissa 1933 : No. 5 : Pp. 31.

The results of the first working year of this Research Station are briefly described. Besides purely agronomic problems, a study is being made of germination and a varietal survey of the indigenous local canes is being undertaken.

Breeding work has shewn the possibility of raising sugar cane varieties in Northern India and a large number of seedlings are under investigation.

Types of Coimbatore canes are being selected for various local conditions.

885. 633.61:575(72.98)
McIntosh, A. E. S. 633.492:575(72.98)
Report of the geneticist for the year 1933–34.
Agric. J. Barbados 1934 : **3**(4) : Pp. 32.

The report deals with investigations covering two crops, sugar cane and sweet potatoes.

Sugar Cane. Under the recent arrangements by which Barbados has been selected as the breeding station for the British West Indies, the work of the Cane Breeding Station has undergone considerable extension. Particularly, it has become necessary to include other than purely noble varieties and for the purpose there are being introduced *S. spontaneum*, *S. barberi* and *S. sinense*. Details are given of the results obtained with the seedlings raised in successive years forming the series B 35 to B 29. In the B 32 series B 3234 has proved so outstanding that it will be carried direct to the variety trials as a competitor of BH 10(12) for the high rainfall districts.

For the B 29 series a number of variety trials has been designed and the plant crop reaped. The outstanding cane here is B 2935 which is peculiarly suited for the low rainfall areas. Work to date indicates the following canes as suited for the areas named : High rainfall BH 10(12), B 726 ; intermediate to high, B 726, BH 10(12) ; intermediate, B 726 ; intermediate to low, B 726, B 2935 ; low, B 2935 ; low, B 2935, B 726, B 11569.

Sweet Potatoes. A record is given of two variety trials, one catch crop and one long crop. The trials include a number of seedlings in 1932. H.M.L.

886. Barke, E. J. 633.61:575(94.3)
Sugar Cane Breeding.
Proc Qd. Soc. Sug. Cane Techn. 6th. Ann. Conf. 1935 : 47–50.

A brief historical account of the Queensland breeding work is given with the important dates : 1890, work started by the Queensland Acclimatization Society developing a Q series of which Q 813 is still a leading cane ; 1901, work commenced by the Colonial Sugar Refining Company and the HQ series developed at Hambledon ; 1921, work commenced by the Bureau of Experimental Stations and the SJ series developed at South Johnstone ; 1928, when the work was extended to other stations and a further Q series instituted.

There follows a discussion of the breeding technique of which a main feature is the testing of disease resistance of the seedlings selected for other good qualities.

Recently work has been extended to other than noble canes and third nobilizations of the wild canes *S. spontaneum* and *S. robustum* have now been effected with promising results. Attempts at nobilization of *S. sinense* (the *Uba* family) are not promising. H.M.L.

887. Singh, T. S. N. 633.61:575.127.2:633.174:576.356
Chromosome number in sugarcane x sorghum hybrids.
Indian J. Agric. Sci. 1934 : **4** : p. 1050.

A very brief note pointing out that in certain crosses between *Saccharum officinarum* (♀) and *S. spontaneum* (♂) where it had been shewn that a doubling of chromosomes occurs on the mother's side, attention has been paid chiefly to the types more nearly resembling the sugar cane (as being more likely to be of economic value). Recent root-tip counts by the author in the Coimbatore cane-sorghum hybrids which resembled sorghum more closely shewed that no such doubling had occurred, indicating that in the same F_1 doubling may occur in certain hybrids and not in others. B.P.P.

888. 633.61:575.22
Hill, A. G. 633.61:575:578.08
Are first year characters maintained in cane seedlings ?
Trop. Agriculture, Trin. 1935 : **12** : 96–99.

In order to obtain further experimental evidence bearing on this problem the author made a comparison of the characters weight per stool, percentage total solids in juice and cane number in his first year selections bred in 1930, and in their second year trial. In the author's opinion characters other than weight and cane number frequently shew up differently in second and subsequent trials, e.g. freedom from arrowing and good bud habit although satisfactory in first year selections may sometimes subsequently deteriorate. Hence it may possibly prove desirable to allow new seedlings to settle down for one or two seasons before attempting to assess their quantitative or qualitative characters.

889. 633.61–2–1.521.6:575(94.3)
KERR, H. W. 633.61–2.3–1.521.6(94.3)
Sugar cane varieties and disease control.
Proc. Qd. Soc. Sug. Cane Techn. 6th Ann. Conf. 1935 : 51–55.
Queensland possesses practically all the major known diseases of cane and, until recent years, the most serious was gumming. Q 813 owes its importance for the industry to its resistance to gumming. Following extensive importations, POJ 2878, succeeded by POJ 2725, Co 290 and POJ 234, were selected on the score of their resistance to gumming, particularly the first. In the last two there are now available canes suited to the southern areas where the older susceptible varieties will be replaced. POJ 2725 is highly susceptible to Fiji disease and, consequently, of limited value. H. M. L.

890. BELL, A. F. 633.61–2.3–1.521.6
Disease resistance trials.
Cane Growers' Quart. Bull. 1934 : 2 : 11–12.
The results of trials for resistance of sugar cane varieties and seedlings to red stripe (top rot) and downy mildew.

STIMULANTS 633.7

891. WENHOLZ, H. 633.71:575(94.4)
Tobacco breeding work of the New South Wales Department of Agriculture.
J. Coun. Sci. Industr. Res. Aust. 1935 : 8 : 51–52.
Considerations of conditions in commercial areas has turned attention from the problem of black root rot (*Thielavia basicola*) to blue mould disease (*Peronospora hyoscyami*). No variety of *Nicotiana tabacum* has been found resistant, though some are more tolerant than others. Some varieties of *N. rustica* are resistant and so is the wild tobacco *N. suaveolens*. Crosses between these and *N. tabacum* varieties are being attempted, although great difficulties are encountered. It is also hoped by crossing the most tolerant *N. tabacum* varieties among themselves to produce a higher resistance.

892. 633.71:575.127.2:576.356:575.242
KOSTOFF, D. 633.71:575.246:575.173
On the increase of mutation frequency following inter-specific hybridization in *Nicotiana*.
Curr. Sci. 1935 : 3 : 302–04.
Numerous interspecific crosses of *Nicotiana* that have resulted in white or pink stripes on the flower petals are enumerated. The stripings usually affected single flowers and the areas so coloured varied greatly in size. Sometimes reverse mutations in the form of red stripes were found in the region of the white ones.
The phenomenon appeared to be more marked in the older hybrids. Crosses between white flowering species produced only white flowers. Species hybrids of *N. tabacum* with distantly related species shewed striping, but with closely related species such as *N. sylvestris* no stripings were observed.
These observations shew that in some hybrids between distantly related species the dominant genes for colour change to their recessive state (white) more often than in the pure species and the reverse mutations to the dominant type are also more frequent. Gene stability appears to be affected by the internal conditions in the hybrid.

893. 633.71:575.129–181.13
KOSTOFF, D. 633.71:575.127.2:576.356.5
Production of dwarf amphidiploid tobacco plants by hybridization.
Curr. Sci. 1935 : 3 : 356–57.
The importance of the combination of the species used for successful interspecific hybridization in *Nicotiana* was again demonstrated by crosses between *N. rustica* var. *humilis* (2n = 48)

and *N. glauca* (2n = 24) which failed and between *N. rustica* var. *texana* (2n = 48) and *N. glauca* which succeeded. The F_1 hybrid on subsequent pollination with N. *rustica* var. *humilis* or var. *texana* yielded triploids (2 *rustica* genoms + 1 *glauca* genom = 60 chromosomes), two tetraploids (amphidiploids) with 72 chromosomes, one pentaploid with 96 chromosomes (3 *rustica* + 2 *glauca* genoms) and various aberrant forms with chromosome numbers ranging from 48–70.
Though the F_1 hybrid was about 150 cm. high (i.e. the same size as the paternal plant) and the maternal plant was about 80 cm. high, the amphidiploids were dwarfs, one in particular being only 12 cm. long. This case is regarded as further evidence that tetraploids are not always giants and that polyploidy plays but a limited role in evolution (Cf. " Plant Breeding Abstracts," Vol. V, Abst. 525). Too great an increase in the chromosome number is thought to lower the vitality of the organism.

894. KVARAZKELIA, T. K. 633.72–1.541:575.12
Vegetative propagation of the tea plant.
Trop. Agriculturalist 1934 : **83** : 362–64.
In the course of grafting experiments it was found that in certain northern and mountainous regions Assam hybrids do not bloom, but if these hybrids be grafted on to northern varieties they begin to bloom earlier and may be used in hybridization for the production of frost-resistant and good quality varieties.

MEDICINAL PLANTS 633.88

895. 633.88:576.312.35
DATTA, R. M. 633.88:581.3
On the development of the embryo sac and the pollen grain in *Cassia Tora*, Linn.
J. Indian Bot. Soc. 1934 : **13** : 277–99.
A full combined morphological and cytological study of megasporogenesis and microsporogenesis and the tapetal cells in *C. Tora*.
A haploid number of 13 had previously been established by the author—a fact which considered with the findings of other workers on various *Cassia* species appears to indicate aneuploidy in the genus.

FRUIT TREES 634

896. 634.11:575–181:581.45
TYDEMAN, H. M. 634.11:575.22
A study of the variations in leaf shape and petiole length in seedlings of " Paradise " apples.
J. Pomol. 1935 : **13** : 32–38.
A further record (Cf. " Plant Breeding Abstracts," Vol. IV, Abst. 333) of the search for easily recognisable morphological characters manifest early in the life of the seedling and genetically linked with economically valuable characters as an aid in selection in the breeding of root-stocks.
Analysis of the parent material and the crosses made seemed to suggest that leaf shape might be due to the action of polymeric factors. The inheritance of leaf petiole length did not appear to have a simple Mendelian basis, but the data were not sufficient to elucidate the type of inheritance involved.
Further and comprehensive investigations are admittedly required.

897. CUTRIGHT, C. R. and MORRISON, H. E. 634.11–2.7–1.521.6:575
Varietal susceptibility to codling moth injury.
J. Econ. Ent. 1935 : **28** : 107–09.
That varietal differences in susceptibility to codling moth injury exist among apples has long been recognised by entomologists. In the present paper what appear to be the main characteristics of susceptible varieties are enumerated and an experiment to ascertain the relative susceptibility of eight varieties is recorded.

Significant varietal differences were found and one variety, Cortland, a hybrid from a Ben Davis x McIntosh cross, is thought to have inherited its susceptibility from its parents. Jonathan and King David proved resistant, the latter particularly so.
Growers should be informed of the relative susceptibility of the different varieties and the possibility of breeding a resistant variety is mooted.

898. Biswas, K. 634.37:575.252:576.16
Observations on the systematic position of *Ficus Krishnae* growing at the Royal Botanic Garden, Calcutta.
Curr. Sci. 1935 : **3** : 424–25.

Attention is drawn to a supposed bud mutation that occurred on *F. Krishnae* C. de C. The mutant portion exhibits broad flat leaves like those of *F. bengalensis*. Germination experiments with seeds of *F. Krishnae* shewed that only about ten per cent bred true the rest resembling *F. bengalensis* ; but when *F. Krishnae* is propagated from cuttings, the daughter plants nearly always have the hypoascidiform leaves of the mother plant.
In the writer's opinion the *F. Krishnae* in question is a horticultural variety of *F. bengalensis*, but a cytogenetical investigation is suggested as the best means of deciding the problem. (Cf. " Plant Breeding Abstracts," Vol. IV, Abst. 586.)

899. Krishnamoorthy, T. and Petel, J. S. 634.61–1.557:575.42:581.192
Yield characters in coconuts.
Proc. Ass. Econ. Biol. Coimbatore 1930/1933 : **1** : 35–36. (Abst.)

Yield records for 12 years at the Agricultural Research Station, Ksaragod, shewed definite positive correlation between yield and total number of leaves, height of trunk, number of female flowers, percentage set, etc., in trees 30–35 years old. Records from a plantation of 12 years' standing shewed a significant negative correlation between age at first flowering and total number of leaves and height of trunk. According to the writers, a tall tree with a large number of leaves is superior in yield and earliness. The results should make it possible in a young plantation to reject at a very early stage trees that would prove poor bearers.
The possibility of using the catalase content of the leaf tissues as a means of seedling selection in the nursery was mentioned.

900. Sarup, S. 634.651:577.84
Sex control in papaya.
J. Indian Bot. Soc. 1934 : **13** : p. 269.

The finding that male *Carica papaya* trees when decapitated may assume purely female characteristics (see " Plant Breeding Abstracts," Vol. V, Abst. 32) is confirmed by an experiment on four trees made at Jodhpur. In spite of conflicting reports from other observers decapitation is therefore worth trying as a means of inducing change of sex in male trees.

901. 634.771:575.42(54)
634.771:582(54)
Research on bananas.
Curr. Sci. 1935 : **3** : p. 458.

A note on the Banana Research Station to be established at Coimbatore under the sanction of the Imperial Council of Agricultural Research, Delhi.
At the new centre work will be done on the survey and classification of varieties, selection of pure lines of new and desirable types and various other problems pertaining to the cultivation, transport and utilization of bananas.

FORESTRY 634.9

902. Day, W. R. 634.97–2:581.02:575
The relation between disease and the constitution and environment of the tree.
J. R. Agric. Soc. 1934 : **95** : 54–72.

Studies on different forest trees have shewn that in a given species there exist numerous races of different inherited constitution, adapted to the conditions in which they naturally occur. When these races are grown under different conditions, trees of inferior quality are produced in

respect of susceptibility to disease, parasitic or non-parasitic, as well as visible characteristics. Variations in susceptibiltity to disease among closely related forms of poplar and in natural hybrids between our two native oaks (*Quercus robur* and *Q. sessiliflora*) suggest that this may be an inherited disposition. Hybrid poplars have been produced with the object of combining disease resistance with ability to produce wood rapidly (see " Plant Breeding Abstracts," Vol. V, Abst. 803).

The effects of soil conditions on growth and susceptibility to disease are discussed and it is shewn that there is an intimate relationship between the constitution of the tree, the environment in which it lives and the development of disease.

903. CRANE, M. B. 634.972.4:575.127.2:576.356.7
The origin of the pink-flowered chestnut, *Aesculus* x *carnea*.
J. R. Hort. Soc. 1935 : **60** : 171–74.

The origin and distinctive characteristics of *Aesculus* x *carnea*, which is regarded as probably having arisen by hybridization between *A. Hippocastanum* and *A. Pavia*, are considered. In many respects *A.* x *carnea* is intermediate between its two putative parents ; it grows to a height of 50–70 feet and has slightly spiny fruits ; but in growth habit and foliage it resembles *A. Hippocastanum*, while in flower colour and petals it is more like *A. Pavia*. When propagated sexually it is fertile and breeds approximately true.

Owing to the clear difference in size of the chromosomes it has been possible to identify the respective complements of the two parent species and thus establish the hybrid origin of *A.* x *carnea* ; it contains the combined number of both parents, which have 20 pairs each, though how chromosome doubling occurred is not known.

The restoration of fertility following chromosome reduplication is in the present case attributed to autosyndesis, since the parental types do not reappear and any minor variations in the progeny are probably due to heterozygosity in one or other or both of the original parents.

904. 634.972.8:575.127.2:576.16
BANCROFT, H. 634.972:575(42)
The elm problem.
Quart. J. For. 1935 : **29** : 102–06.

A note on the genus *Ulmus* as represented in Britain and with special reference to the problems of the species and possible cases of hybridization.

Morphological and anatomical studies of living and fossil types, cytological and genetic investigations must all be combined in an attack on these special problems in *Ulmus*. Those interested are invited to cooperate by controlled breeding experiments or the supply of material.

905. KRISHNASWAMI, N and RANGASWAMI AYYANGAR, G. N. 634.976.26:576.312.35
Chromosome numbers in *Sesbania Grandiflora* Pers.—The Agathi plant.
Curr. Sci. 1935 : **3** : p. 488.

In two varieties of this soft wood tree, the common pole, white-flowered type and the short early branching, red-flowered form, observations on pollen mother cells and pollen grains shewed a haploid count of 7.

The cytological characteristics of the chromosomes which were larger in the pollen grains than the pollen mother cells are noted.

The haploid number in *S. aculeata* Pers. is recorded as 16 by Kawakami.

VEGETABLES 635

906. BEWLEY, W. F. 635.52:575"793"
Cheshunt Early Giant lettuce : a new forcing type.
J. Minist. Agric. 1935 : **42** : 45-47.

The new variety is the result of selection following a chance cross in the experiment field. Its performance during a number of seasons and its ultimate success in the English market are recorded. The Cheshunt Early Giant which is a forcing cabbage lettuce with a leaf somewhat of the Gotte types though darker in colour and much larger is the only variety that will produce a solid heart when the daylight period is less that 10 hours. The whole of the plant is tender and edible. It is not susceptible to tip burn or internal rot, stands well and does not bolt before the end of April.

STATISTICS 519

907. 519.24
YANG, Y. K. 631.421
(Suggestion of a new formula for the deviation of the mean method).
Hopei Agric. For. 1935 : Pp. 20.
YANG, Y. K. and TSUEI, C. Y.
(A study of the application of some methods for calculating experimental errors).
Hopei Agric. For. 1935 : Pp. 24.

In the first paper, after identifying " Student's " formula for the experimental error of the " paired " method in the case of correlated observations with Fisher's calculations by means of analysis of variance, eliminating block differences, the author goes on to derive, with the aid of Fisher's methods for dealing with two uncorrelated samples, a " new formula " for experimental error which differs from the corresponding formula of " Student," block differences not being eliminated, by a factor $\sqrt{2}$. The formulae are in reality, however, identical, the difference arising from the author supposing that Fisher's estimate of standard deviations was that of a difference between two experimental values. This fact renders useless the comparison in the second paper of the two formulae, but the comparison given therein with Richey's moving average method is of some interest. J.W.

908. SNEDECOR, G. W. and COX, G. M. 519.24:631.421
Disproportionate subclass numbers in tables of multiple classification.
Res. Bull. Ia. Agric. Exp. Sta. 1935 : No. 180 : 235–72.

Modern methods of experimentation are particularly well adapted for the elucidation of several effects, and their interactions, when incorporated in one and the same experiment. The data can be grouped in tables of multiple classification, and straightforward methods are all that are required when the numbers are equal for all classes. If unequal, but proportional, there is only a slight increase in complication in the statistical analysis. Methods, however, are required for use when the numbers are disproportionate, a situation that frequently arises. This matter has engaged the attention of a number of writers, and various approximate solutions are available. These are fully described in this paper, and a new method, that of " expected subclass numbers," is proposed. The methods are fully illustrated, and it is concluded that satisfactory amounts of information can be extracted from such tables, while so far as the reported experimental results are representative, the usual methods, ignoring disproportion, are shewn to be approximately applicable. Full references to papers on the subject are provided. J.W.

909. STROMAN, G. N. 519.241.1
Procedure for rapid calculation of multiple correlation coefficients.
J. Agric. Res. 1935 : **50** : 59–69.

An account of some simplified methods devised for obtaining multiple correlations by the modern electric calculator. It is claimed that the new processes not only save time and labour but also give a higher degree of accuracy.

GENETICS 575

910. FINKELSTEIN, E. A. 575.1
(The part played by A. Weissmann in the development of the theory of heredity and ontogenesis.)
Priroda (Nature) 1935 : No. 1 : 59–65.

The author shews the fallacy of the view that Weissmann's theory had nothing in common with Mendel's, for Weissmann in 1885 pointed to the chromosomes as the carriers of the hereditary material, from which he deduced the necessity of segregation in hybrids when self-pollinated. Weissmann further stated the principle of dominance and of the existence of independent determinants for each hereditary character. He in no way denied the influence of the external medium on the hereditary constitution of the germ cells, but made a clear distinction between this and the inheritance of acquired characters. His main error was in his theory of embryonic differentiation leading to the separation of the hereditary constituents of different groups of cells.

911. Tsŭ, W. H. 575.143:519.24
The formulae for the automatic increase of homozygosis in brother and sister mating.
Jap. J. Genet. 1935 : **10** : 216–17.
Formulae are derived for the proportion of homozygosis after *n* generations of brother-sister matings after an original cross involving *m* pairs of characters in the cases where, in the original cross (1) each pair of characters is homozygous, (dominant in one individual and recessive in the other), (2) each pair of characters is heterozygous, (3) each pair is homozygous (dominant or recessive) in one individual and heterozygous in the other, and (4) the characters belong to two or three of the types mentioned above.

912. Michaelis. P. 575.182:575.12
Erhöhte Wachstumsintensität und Pilzresistenz durch Plasmavererbung, sowie über die Bedeutung des Plasmas bei Kreuzungschwierigkeiten. (**Increased growth intensity and resistance to fungi through plasmatic inheritance as well as the significance of the plasma in difficulties experienced in hybridization.**)
Züchter 1935 : **7** : 74–77.
The significance of the plasma as an independent carrier of hereditary characters has already been stressed by the author (see " Plant Breeding Abstracts," Vol. V, Abst. 600). Further proof is here presented from the results of continuous back-crossing of the hybrids of *Epilobium luteum* ♀ x *E. hirsutum* ♂ to the male parent and assuming that no cytoplasm is carried over with the male nucleus by the tenth and eleventh back-cross generation the plasma of *E. luteum* contains a homozygous nucleus of *E. hirsutum*. Comparison of these back-crosses with normal *E. hirsutum* plants revealed a number of differences of which only those of interest to the practical breeder are mentioned here.
Although when grown in the field or in large pots there was no difference in the size and growth of the plants, if the size of the pot was reduced, then the smaller the pot and the less nutrient material available, the clearer were the differences between the two types. In total height the plants were about equal but the hybrid plants (Lh'') shewed a marked increase in the number of side branches from the base of the plant and in the breadth of the leaves, so that if *E. hirsutum* were used as a forage plant the back-crossed hybrids would shew a much higher yield on poor soils.
In 1934 the cultures of *E. hirsutum* were badly attacked by mildew. The back-crossed plants were also attacked but only slightly.
The possible role of the plasma in such back-cross plants is briefly discussed.

913. Stomps, T. J. 575.2:575.191
575.4
575.17
575.1
De mutatietheorie in hare beteekenis voor onze semenleving. (**The mutation theory in relation to its significance in our social life.**)
W. Versluys (N.V), Amsterdam, Batavia, Paramaribo, 1935 : Pp. 31.
In this address to the University of Amsterdam the mutation theory of Hugo de Vries is considered in its various aspects with special reference to the problems of mutation, environmental influences on heredity, Darwinism, the gene theory and finally eugenics.

914. Navashin, M. S. and Gerasimova, E. M. 575.24:581.01
(Change in varietal qualities in seed during ageing.)
Semenovodstvo (Seed Growing) 1935 : No. 1 : 36–46.
An account of the work reviewed in " Plant Breeding Abstracts," Vol. III, Abst. 552, with a discussion of its implications from the point of view of practical breeding and seed production.

915. 575.24:581.036
575.24:581.032
SHKVARNIKOV, P K.. 633.1:575.242:581.03
(Influence of temperature and moisture on the process of mutation in resting seeds.)
Semenovodstvo (Seed Growing) **1935** : No. **1** : 47–52.

Fresh seeds, gathered the previous year, of *Crepis tectorum* were retained in the thermostat at 54°C. for 20 days and the 14 healthy plants obtained were examined cytologically. Root tip examinations shewed 9 of them to be chromosome mutants, all cells of the root shewing the same mutant changes. The number of mutations found in normal fresh seeds is below one in a thousand and the calculated acceleration therefore amounts to 600 times or over.
Temperatures of 40°C. acting for 20 days were also applied and out of 20 plants tested 10 shewed marked chromosomal aberrations, which were observed even after treatment at 35°C. for only 10 days. The same effect was observed in plants from seeds in which the moisture content had been raised and from seeds kept for 20 days in an atmosphere of carbon-dioxide.
Various abnormalities of growth and ears were observed also in plants of wheat and rye from old seeds and from seeds subjected to high temperatures.

916. SHKVARNIKOV, P. K. and NAVASHIN, M. S. 575.24:581.036
(Acceleration of the mutation process in resting seeds under the influence of increased temperature.)
Biologičeskii Ž. (J. de Biol.) **1935** : **4** : 25–38.

A detailed account of the work referred to in " Plant Breeding Abstracts " Vol. IV, Abst. 1 with descriptions and illustrations of the types of translocation and other irregularities observed which occurred in 60 per cent of the surviving plants. In addition to these, various factorial mutations were also observed.
Further experiments were carried out on *Crepis tectorum* and winter wheat, subjecting the seeds to 30°C., 40°C., 50°C. and 60°C. for varying periods, and to the influence of the sun's rays, which engendered a temperature varying from 24·3 to 49·3°C. Cytological examinations were made on twenty plants from the seeds exposed to 40°C. for 21 days and over. Mutant cells were observed in ten of them, consisting of fragmentation, translocation, etc.
There was no direct relationship between the duration of the action of high temperature and the number of mutants, which increases very rapidly in the later stages, finally ending in the death of the seeds. Moreover there is a very marked loss of susceptibility to this effect in seeds which have passed the resting stage and begun to germinate. These two facts together suggest that the phenomenon is connected in some way with the metabolic state of the cells and certainly prove that it is not a purely physical effect. For this reason the processes occurring in resting seeds at high temperatures and with different moisture contents are considered to be in no way different from those occurring in resting seeds under normal conditions ; the only difference is one of degree and such studies are regarded as valid for the investigation of the processes occurring in nature.
The action of high temperature is expected to provide a method both more convenient and more efficient for the production of artificial mutations in breeding and other work. Attention is directed to the danger of mass mutation occurring in heated stacks and other seed stores where insufficient care has been taken to provide suitable storage conditions, also in various cases where high temperatures are employed in processes of seed treatment and where seeds are exposed to the action of the sun's rays.

917. SCHLÖSSER, L. A. 575.255:575.182:575.24:635.64
635.64:575.061.633
Die experimentelle Herstellung einer *peraurea*-grünen Periklinalchimäre und ihre Bedeutung für das Determinations-problem. **(The experimental production of a *peraurea*-green periclinal chimaera and its significance for the problem of determination.)**
Z. indukt. Abstamm. u. VererbLehre **1935** : **68** : 222–41.

The experimental material came from a plant of a wild strain of *Solanum Lycopersicum* with

chlorophyll-deficient patches on the upper and under sides of the leaves and on the sepals. The plant was vegetatively propagated in order to study the origin of the chlorophyll-deficient cells. The distribution of the green and light-yellow tissue throughout the plant is described in detail. Crosses were also made between variegated x green plants and the reciprocal which gave always yellow seedling, in the first case and green in the second.
The results are taken to indicate that a " plasma " mutation must have occurred involving a small group of cells or even a single cell in the very early stages of germination or in the seed.

ORIGIN OF SPECIES, ETC. 576.16

918. FISCHER, H. 576.16
Pflanzenstandorte und Vererbungslehre. **(Plant habitats and genetics.)**
Repert. Spec. Nov. reg. Veget. Beih. 1934 : **76** : 164–72.
Cases are quoted of plants which for generations have been subjected to the influence of a particular set of ecological conditions without being in the least altered ; and further of a number of different, even opposite, vegetative characters associated with plants adapted to a particular set of conditions, e.g. in the plants of arid ground. Again, plants adapted to one type of conditions still retain their capacity to change adaptively when introduced into new conditions. These and other similar arguments refute the hypothesis of direct action of environment. Natural selection and mutation are adopted as the driving forces of plant evolution.

919. GODDIJN, W. A. 576.16:575.12
576.16:576.312.32
On the species conception in relation to taxonomy and genetics.
Blumea 1934 : **1** : 75–89.
The author points out that theories of evolution are chiefly concerned with the origin of species, the taxonomic units. After brief mention of the theories of Lamarck, Darwin, and De Vries, he discusses at some length the ability of hybridization to produce diversity of forms, and, in conjunction with other factors, such as isolation, ecological conditions, selection, or automatic reduction of polymorphy, and its importance in the production of new species. The views of Lotsy, Danser, Hagedoorn, Turesson, Du Rietz, and others on the species concept are reviewed in this connexion.
From the cytogenetic standpoint mutations, structural differences between the chromosomes and polyploidy are regarded as important in the delimitation of species, and Babcock's conception of the species is given, being an attempt to reconcile the taxonomic and genetic views. Although theories of the origin of species are thus seen to have some experimental basis, the problem of phylogeny remains speculative, and the author suggests that Lamarckian views of adaption may have to be more seriously considered.

CYTOLOGY 576.3

920. 576.354.46
SATÔ, D. 633.526.43:576.312.35
Chiasma studies in plants, II. Chromosome pairing and chiasma behaviour in *Yucca*, *Scilla* and *Urginea*, with special reference to interference.
Bot. Mag. Tokyo 1934 : **48** : 823–46.
From the results of a detailed study of chiasma behaviour in the plants mentioned the data on chromosome pairing, reduction of chiasmata, terminalization and position of spindle attachment, interference and chiasma behaviour and chromosome length, are discussed with special relation to the two opposed theories of Sax and Darlington.
Yucca recurvifolia (n = 30) was found to have 5 large and 25 small bivalents.

921. KOSTOFF, D. 576.354.46:576.356.52:633.71
(Studies on polyploid plants. VIII. Chromosome conjugation in the haploids and its genetical significance.)
G. R. Acad. Sci. URSS. 1935 : 1 : 330–32.
A detailed study of meiosis in haploid plants of *Nicotiana Langsdorffii* and *N. sylvestris* shewed that in the first case one bivalent was frequently observed and two to three occurred occasionally ; in the second case, up to six bivalents were observed. The conjugation appeared to be loose, terminal association being most frequent, but in a few cases real interstitial chiasmata were formed in the case of *N. Langsdorffii*.
The conclusion is drawn that crossing-over occurs between homologous segments of the non-homologous chromosomes in these haploids and therefore such plants cannot be regarded as " absolute homozygotes."

922. TISCHLER, G. 576.356.5:581.9
Die Bedeutung der Polyploidie für die Verbreitung der Angiospermen, erläutert an den Arten Schleswig-Holsteins, mit Ausblicken auf andere Florengebiete. **(The significance of polyploidy for the distribution of the angiosperms—exemplified by the species Schleswig-Holstein, and considered in the light of the flora of other regions).**
Bot. Jb. 1935 : 67 : 1–36.
Setting out from the idea that polyploid races or species occur in increased numbers in regions characterized by extremes of climate, the author investigates the available data on the amount of polyploidy in Schleswig-Holstein, which has an area of 20,100 sq. km.
In this Province the chromosome numbers of about two-thirds of the wild species or those species accepted as now having become indigenous are known ; and of this two-thirds the polyploid species comprise at least 44 per cent or over two-fifths. This proportion increases for species extending northwards to 60 per cent, while for species the distribution of which is towards the south the corresponding figure is only about 27 per cent.
According to a similar estimate (though based in this case on admittedly inadequate data), the angiosperms of Iceland and the Faroes shewed a much higher proportion of polyploids than in Schleswig-Holstein, while among the angiosperms of Sicily the number is relatively very much lower.
The author holds that his findings as regards the Schleswig-Holstein flora confirm Hagerup's theory on the occurrence of polyploidy as a consequence of extremes of climate in Timbuctoo and Greenland, though this explanation does not always apply, as Hagerup himself shewed (Cf. " Plant Breeding Abstracts," Vol. IV, Abst. 253).
A series of species with diploid and polyploid chromosome numbers is tabulated, 3 per cent belonging to the Schleswig-Holstein district, and the significance of tetraploid and hexaploid races in the production of " constant " hybrids is pointed out. Attention is also drawn to the inherent possibilities of a system of auto- and alloploidy in providing the variants upon which selection can act, thus producing types capable of colonizing climatically different regions.
The question of structural hybridity and possible instances of the condition are mentioned.

BOTANY 581

923. JANNACCONE, A. 581.143.26.03
La " jarovizzazione " delle colture nella teoria e nella practica. **(The vernalization of cultivated plants in theory and in practice).**
Ann. Tec. Agr., Roma 1935 : 8 : 216–25.
A brief exposition of Lyssenko's theory of vernalization.

924. FOKEEV, P. 581.143.26.03:633.1
(The correct application of ultra-early sowing.)
Socialistic Grain Farming, Saratov 1935 : No. 1 : 33–44.
The results of ultra-early sowings 1934 shewed that in some regions a higher yield was obtained than by the ordinary sowings at late dates but this was below the normal early sowings ; in

other regions the ultra-early sowings were equal in yield to the normal early sowings and in some were higher. In these latter cases the yields were equal to those of the vernalized sowings, since conditions had been such as to effect natural vernalization. This occurred when there was a sufficiency of surface moisture in the soil and suitable temperature conditions for the swelling and germination of the grain. For this reason the depth of the snow covering is an important factor favouring the ultra-early sowings.
A further great advantage of ultra-early sowing is the gain in time ; sowing is completed about 6 days earlier.

925. VARFOLOMEEVA. 581.143.26.03:633.11
(Variety testing with vernalization.)
Semenovodstvo (Seed Growing) 1934 : No. 3 : 38–40.
The Bezenčuk station made tests in 1932 of a number of local strains of spring wheat, both *Triticum vulgare* and *T. durum*, after vernalization. There were 33 late spring varieties of *T. durum*, of which 26 shewed acceleration in earing after treatment, and 20 early varieties, of which 8 shewed acceleration. The emergence of the seedlings was 1-3 days earlier in the treated plots and most of the late varieties after treatment eared together on the 26th–27th June, whereas the earing period of the untreated extended from 27th July* to 4th August. The treated late wheats were thus as early as the local standard, *hordeiforme* 0189, which untreated eared on June 27th in 1932.
The experiments in 1932 were done on an area of 2.5 sq.m. only, but in 1933 were repeated on 75 sq.m. Twenty-four late varieties of *T. durum*, three new selections of the station and the standard wheats were tested. The treatment was that recommended for late varieties except in the case of the standard varieties, which were treated also by the method for early varieties. Of the 31 varieties treated by the method for late varieties, 25 shewed accelerations in earing of 1 to 5 days and of the 7 varieties treated by the early variety method, 4 gave accelerations of 1 to 3 days.
The late varieties of *T. durum* reacted more than the early ones both in 1932 and 1933. The crop suffered from drought in both years but 15 out of the 24 varieties tested shewed yield increases as a result of treatment, the increases varying from 6 to 58 per cent. (See Table 3.)
The standard varieties gave little or no acceleration in both methods of treatment but *hordeiforme* 0189, though not accelerated in ear emergence, shewed in each case an increase in yield. An earlier maturing standard variety, *melanopus* 069, reacted definitely more to the treatment for early varieties than to the treatment for late varieties, and *caesium* 0111 shewed a slightly greater yield increase in the treatment for early varieties, though its ear emergence was accelerated only by 1–2 days (Table 4).
When treatment was applied to the whole world collection of wheats at the Bezenčuk station 950 of them (26.5 per cent) gave no acceleration in ear emergence. However the size and weight of grain was increased in nearly all varieties.
The conclusion is therefore reached that vernalization is a valuable agronomic measure, increasing the yield and quality of grain as well as the earliness, and its wide application in practice is recommended.

926. VASSILIEV, I. M. 581.143.26.03:633.11
(I. On factors of the vernalization of the wheats.)
Socialistic Grain Farming, Saratov 1934 : No. 6 : 51–55.
Lyssenko, even in his latest publications, states that low temperature and long day are obligatory conditions for the first and second developmental stages respectively, although it has already been shewn beyond question that winter cereals will come into ear without any low temperature at all, even in a hothouse, if sown sufficiently early in the spring. This was shewn as early as 1914 by Murinov and confirmed ten years later by Maximov and Pojarkova, Vakar and others ; more recently still the same phenomenon has been shewn by McKinney and Sando and by Lebendinceva.

* *Sic*, possibly misprint for June? [reviewer's note].

At the Institute of Grain Husbandry at Saratov unvernalized sowings of a number of winter wheats were made in pots in November, after which they were subjected to different conditions of light and temperature. All series came into ear but at different times. Series I was grown for 45 days from the time of sowing at a temperature of 8–10°C. under natural illumination, amounting to 7–8 hours per day, after which it was transferred to continuous light at a temperature of 20–25°C. ; this series was the one which eared first. The latest to ear was Series IV kept for the whole time in continuous light at 20–25°C. Even these plants however came into ear, although the conditions of growth were well outside the limits stated by Lyssenko as obligatory for ear formation. Series II was grown for 12 days from the time of germination at 8–10°C. and in natural light, then in continuous light at 20–25°C. and series III was grown for 45 days at 20–25°C. in a 9 hour day, after which it was transferred to continuous light at 20–25°C. Both these two series shewed delayed ear development A control series of the same varieties was vernalized and grown in continuous light at 20–25°C.; all the vernalized wheats came into ear some time before any of the above series, though the actual number of days required for ear emergence was no less than the first series if the length of time required for vernalization is taken into account. Thus the experiments shew that the conditions described by Lyssenko as necessary for ear production are not by any means the only ones under which this may occur ; they further shew that the conditions described by Lyssenko are not even those which bring about ear formation in the least possible length of time.

927. 581.143.26.03:633.11(43)
581.143.26.03:633.14(43)

Dix, W.

Jarowisationsversuche mit Getriede. (**Vernalization experiments with cereals.**)

Dtsch, landw. Pr. 1934 : **61** : p. 644.

Seed of two winter wheat and two winter rye varieties was soaked for 24 hours in water, then transferred to a cool cellar at a temperature of 1–4°C. where it was kept for 45 days. During this period it was stirred twice. On 20th March, 1934, the treated seed was sown together with untreated seed of the same variety in four replications. The seedlings appeared above ground on the 7th April in the treated and on the 9th April in the untreated sets and a few weeks later the treated seedlings were clearly more vigorous and more advanced in growth. The difference was especially marked in the rye plants and these came into ear regularly and uniformly, only three weeks after autumn sown rye, whereas the vernalized wheat, though it was more luxuriant in growth, only produced a few isolated ears. In the untreated wheat however no ears at all were formed. The vernalized rye was harvested on the 10th August, the winter sown rye on the 26th July.

The effect of vernalization is clearly reflected in the yield figures.

From both rye varieties the yield of straw is increased by 2½ times and the yield of grain by 14–16 times. The fact of vernalization is thus abundantly proved. However, whether it can be recommended for German conditions is largely open to doubt. With wheat it certainly can not, and even in the case of rye the yields after vernalization are only half those from autumn sowing ; and the possibility of having a period of 45 days of such a kind as to maintain the temperature of 2–4°C., neither more nor less, is always very doubtful. Thus vernalization is still regarded as a matter of some risk, but great prospects for it are admitted if by its aid it should become possible to cultivate successfully certain crops such as soya bean whose cultivation in Germany is still impossible or impracticable.

928. 581.143.26.03:633.11–2.111

*Vassiliev, I. M.

(**II. Vernalization of winter crops and their cold resistance.**)

Socialistic Grain Farming, Saratov 1934 : No. 6 : 55–58.

Winter forms, i.e. those which do not come into ear on spring sowing, are known to be more hardy than spring forms of the same cereal. Experiments were started in 1932 to shew that vernalization also reduces the hardiness of winter forms. Both hardy and susceptible winter

* An abridged translation is on file at the Bureau.

wheats were vernalized and exposed to frosts in varying ways, controls unvernalized being subjected to identical conditions. In all cases the vernalized plants were badly damaged by the frost, the controls being more or less unaffected. The frost resistance of a plant is thus influenced not only by the conditions of its hardening but also by its stage of development in Lyssenko's sense, in consequence of which extra early sowings tend to be less frost-resistant on account of the completion of the stage of vernalization which this usually effects.

929. 581.143.26.03:633.14
581.143.26.03:633.11

ELEMA, J.

Een aardige proef. (**A striking test.**)

Drentsch Landbouwblad 1934 : August 9th.

Though vernalization is not expected to have any great practical application in Holland it is of undoubted theoretical significance. Experiments at Groningen have demonstrated the difference in reaction of different varieties of cereals and at Wageningen it has become evident that different varieties require different temperatures for successful treatment and that these must be applied for varying lengths of time.

On 15th December, 1933, J. Semmelink treated moistened seed of Juliana wheat and Petkuser rye by exposing it to a temperature of 2–4°C. in an outhouse, the temperature being controlled by opening and closing the windows. The treatment lasted for six weeks, till February 1st, 1934. The author sowed the seed on April 1st, together with controls of untreated seed.

The treated plants at first developed somewhat more slowly, probably owing to the seed having been dried before sowing. A little later however enormous differences in favour of the treated plants were observed in the rye, the untreated plots of which remained in the grass-clump stage whilst the treated plots went ahead normally just like spring rye. A few of the control plants formed small ears very late in the season, whilst all the vernalized plants came into ear normally.

The effect of treatment in the Juliana wheat was of a similar type though very much less pronounced than in the rye, so that not even all the treated plants produced mature ears.

930. 581.192:581.9:582

MCNAIR, J. B.

The taxonomic and climatic distribution of alkaloids.

Bull. Torrey Bot. Cl. 1935 : **62** : 219–26.

A further study (Cf. " Plant Breeding Abstracts," Vol. V, Abst. 287) bearing on the climatic and taxonomic distribution of the alkaloids, the relations between the molecular weights, carbon, hydrogen and oxygen content of alkaloids, the climatic habitat of the plant families producing them and specificity of alkaloids with regard to species, genera and families.

The findings are based on data compiled by Boas and Couch in addition to those used in the author's previous work.

FIELD TESTS 631.421

931. 631.421:519.24

BURDET, W.

Het uitschakelen der systematische variatie oorzaken bij het proefveldonderzoek volgens Knut Vik. (**The elimination of the causes of systematic variation in field experimentation, by the method of Knut Vik.**)

Landbouwk. Tijdschr. Wageningen 1935 : **46** [sic. 47 ?] : 88–94.

The writer, while paying tribute to the excellent manner in which Ir. A. Bigot, in the 1934 September and October issues of this journal (Cf. " Plant Breeding Abstracts," Vol. V, Abst. 268), succeeded in his object of setting out the principles of modern experimentation and the theory of the analysis of variance, as evolved by R. A. Fisher, draws the attention of experimenters also to the method of Knut Vik, which he illustrates by an actual example.

The method is applicable to layouts of the Latin Square type, 5 x 5, 7 x 7, or 9 x 9, etc., and conforms to the usual requirements of the Latin Square, except that the treatments are arranged in a systematic manner and not randomized. Without resorting to Fisher's method of eliminating row and column variation, a specialized technique enables the writer to obtain an estimate of random error freed from all systematic soil variation. He considers the underlying conception and ease of manipulation of this technique to be simpler than that of Fisher, but admits his inability to produce a mathematical proof of the validity or superiority of the method.

G. B. L.

932. Przyborowski, J. and Wileński, H. 631.557–1.421:519.24
Wyzyskanie korelacji między plonem i innemi mierzalnemi cechami poletek przy opracowywaniu doswiadczeń polowych. (**On the use of correlation between yield and other measurable characters of single plots in reducing results of field experiments.**)
Rocz. Nauk Rol. 1935 : **34** : 273–86.
A mathematical derivation of the formulae to be used when, in addition to the arrangement of a number of treatments in blocks in a field experiment, it is desired to correct for the influence of another variable by calculating the regression or correlation of yield on this variable.
J. W.

PLANT DISEASES 632

933. 632.4:576.16:633
632.452:576.16:633.1
632.451:576.16:633.1
Reed, G. M. 632.42:576.16:633.1
Physiologic specialization of the parasitic fungi.
Bot. Rev. Lancaster, Pa. 1935 : **1** : 119–37.
A general survey of existing knowledge on the methods of detecting physiological forms, the geographical distribution of races, physiological specialization in various rusts, smuts, etc., morphological variation, constancy and origin of specialized races and the effect of environmental factors on the reaction of differential hosts.
There is an extensive bibliography.

934. 632.42:575.22:634.23
Magie, R. O. 632.42 *Coccomyces hiemalis* : 576.16:634.23
Variability of monosporic cultures of *Coccomyces hiemalis*.
Phytopathology 1935 : **25** : 131–59.
Variability in culture and on species of *Prunus* was studied in a number of single ascospore isolates of *C. hiemalis* and morphological and physiological variations were found. Though some isolates also differed in their pathogenicity, the results did not indicate the existence of physiological forms.

935. 632.42:576.16:633.11
Nisikado, Y., Matsumoto, H. and Yamauti, K. 633.11–2.42–1.521.6
Studies on Fusarium-blight of cereals in Japan. I.
On the physiological specialization of *Gibberella saubinetii* (Mont.) Sacc. in the pathogenicity [sic.] to wheat seedlings.
Ber. Ōhara Inst. 1934 : **6** : 431–48.
Samples of *G. saubinetii* numbering 124, received from wheat and barley growing in various localities in Japan, were used in investigating the pathogeneity of the fungus on wheat as a preliminary to a study of its physiological specialization. Certain collections proved highly virulent, others were non-pathogenic and others were of intermediate strength.

936. Allison, C. C. 632.451.2:575.12:633.16
Hybridization between *Ustilago hordei* and *U. medians*.
Phytopathology 1935 : **25** : p. 5. (Abst.)
Tested on six varieties of barley, all the F_1 dicaryophytes of crosses between monosporidial lines from a cross between *U. hordei* x *U. medians* were distinct in their pathogenicity. Head type was intermediate in the F_1 and the chlamydospores were echinulate. There was segregation for a number of characters in F_2.

937. TYLER, L. J. and SHUMWAY, C. P. 632.451.2:575.127.5:633.174
Hybridization between *Sphacelotheca sorghi* and *Sorosporium reilianum*.
Phytopathology 1935 : **25** : 375–76. (Abst.)
A successful cross between *Sphacelotheca sorghi* (Link) Clinton and *Sorosporium reilianum* (Kuhn) McAlpine is described. Chlorotic flecking of sorghum plants was obtained by injections of monosporidial lines of the two species and when the plants approached maturity sori, containing chlamydospores, developed in the inflorescences of some. The morphological characteristics of both sori and spores which were of an intermediate type between those of the parent forms are discussed. The cultural characteristics, pathogenicity and genetics of the new hybrid are being studied.

938. STAKMAN, E. C., TYLER, L. J., 632.451.2:576.16:633.15
HAFSTAD, G. E. and SHARVELLE, E. G. 632.451.2:575.25
Experiments on physiologic specialization and nature of variation in *Ustilago zeae*.
Phytopathology 1935 : **25** : p. 34. (Abst.)
The results of inoculating six varieties of maize with ten collections of *U. zeae* for three successive years shewed that the collections differed consistently in pathogenicity. Investigations were made on the frequency of sectoring in monosporidial lines and evidence is presented to shew that the tendency is genotypically determined.

939. 632.451.2:576.16:575.127.2
632.451.2:577
RODENHISER, H. A. 632.451.2:575.11
Studies on the possible origin of physiologic forms of *Sphacelotheca sorghi* and *S. cruenta*.
J. Agric. Res. 1934 : **49** : 1069–86.
Using single sporidial lines isolated from promycelia of chlamydospores of forms 1, 2 and 3 of *Sphacelotheca sorghi*, form 1 of *S. cruenta* and F_1 intra- and interspecific hybrids, investigations were made on sexuality, hybridization and segregation, cultural characters and pathogenicity.
From the results it is evident that physiological forms of both organisms may be produced by hybridization between pathogenically distinct strains of *S. sorghi* and between *S. sorghi* and *S. cruenta*, diploid hyphae being thus formed containing the hereditary factors of two parental lines.
Factors controlling the sex of sporidia, the general morphology of the sori, the colour of peridia and the degree of stunting of the host were independently inherited and intermediate types were produced following interspecific hybridization.
It is believed that crossing may occur in nature ; and tests of the pathogenicity of hybrid and parental lines shewed that pathogenically distinct strains may result from hybridization.
As regards the taxonomic relationship of the two fungi, the author inclines to the view that they are distinct species, exhibiting in the F_1 what may be regarded as genetic sterility, a characteristic of interspecific hybrids. (Cf. " Plant Breeding Abstracts," Vol. III, Abst. 222.)

940. CHRISTENSEN, C. 632.451.2:576.356.5
Haploide Linien von *Ustilago tritici*. (**Haploid lines of *U. tritici*.**)
Züchter 1935 : **7** : 37–39.
The method used for obtaining the haploid lines is described. Plants of Peragis wheat were inoculated with haploid lines and with combinations of haploid mycelia and only in the latter case did infection occur.

941. YOUNG, P. A. 632.451.3:576:16:633.11
A new variety of *Tilletia tritici* in Montana.
Phytopathology 1935 : **25** : p. 40. (Abst.)
The characters distinguishing this new variety from *T. levis* and other forms of *T. tritici* are given.

942. 632.452:576.16
STAKMAN, E. C., HINES, L., CASSELL, R. C. and LEVINE, M. N.
Population trends of physiologic forms of *Puccinia graminis tritici*, 1930 to 1934.
Phytopathology 1935 : **25** : p. 34. (Abst.)
The changes in the relative prevalence of physiological forms of *P. graminis tritici* in Mexico and the U.S.A. from 1930–1934 inclusive are reviewed.

943. ALLEN, R. F. 632.452:577.8
A cytological study of heterothallism in flax rust.
J. Agric. Res. 1934 : **49** : 765–91.
Proof of heterothallism was found in the flax rust *Melampsora lini*.

944. 632.452:577.8:581.162.4:633.15
ALLEN, R. F. 632.452:577.8:581.162.4:633.174
A cytological study of heterothallism in *Puccinia sorghi*.
J. Agric. Res. 1934 : **49** : 1047–68.
Evidence is advanced to shew that *P. sorghi* Schw. is a full cycle heteroecious, heterothallic rust producing spermogonia and aecia on *Oxalis oxalis* and media and telia on maize.
The attainment of the bisexual condition, fertilization and various other relevant problems arising out of the main investigation are examined in full.

945. 632.48:576.16:633.16
CHRISTENSEN, J. J. and GRAHAM, T. W. 633.16–2.48–1.521.6
Physiologic specialization and variation in *Helminthosporium gramineum* Rab.
Tech. Bull. Minn. Agric. Exp. Sta. 1934 : No. **95** : Pp. 40.
More than 125 races can be distinguished in culture on artificial media and at least 20 races by reaction with 16 varieties of barley. No variety was completely susceptible to all races ; Black Hull-less, Spartan and Trebi were among the most resistant varieties.

946. GRAHAM, T. W. 632.484:575.22:576.312
Nuclear phenomena in *Helminthosporium gramineum*.
Phytopathology 1935 : **25** : 284–86. (Abst.)
A cytological study of various growth stages of *H. gramineum* strongly suggested that heterokaryosis is at least in part responsible for variation in this pathogen and the production of new races.

947. NELSON, R. and COCHRAN, L. C. 632.484:576.16:635.53
Three forms of the *Fusarium* wilt of celery.
Phytopathology 1935 : **25** : p. 29.
The distinguishing symptoms on the host plant caused by the three forms of *Fusarium* wilt or yellows of celery are described.

ECONOMIC PLANTS 633

948. 633:575(47)
(Soviet plant industry at the eve of the 7th Soviet Congress.)
Semenovodstvo (Seed Growing) 1935 : No. 1 : 3–5.
In reviewing the achievements in agricultural science in the Soviet régime, mention is made of a number of new wheats produced, some suitable for growing further north, of the evolution in plant breeding brought about by the discovery of vernalization (over a million hectares having been sown in 1934 under vernalized crops) and of the success in interspecific and intergeneric crossing achieved by Michurin and by the Saratov station.

949. 633:575(48.5)
633:575(48.1)

Åkerman, Å.

Modern växtförädling och dess beytdelse för jordbruket. (**Modern plant breeding and its importance for agriculture.**)

Tidsskr. Norske Landbr. 1935 : **42** : 81–106.

The historical development of plant breeding in various countries, the various methods of genetic investigation, the successes attained and the problems pertaining to research on the different agricultural crops are outlined.

Special attention is drawn to the principles followed in Sweden of (1) co-operation between central institutes and affiliated stations throughout the country and (2) local research in breeding for plants suitable to particular regions. The importance of well equipped institutes with adequate funds and unhampered by commercial interests is also emphasized.

950. 633:575(51)
633.1:575(51)
634.972:575(51)

[The National Agricultural Research Bureau of the Ministry of Indurtries. History and scope of work (July, 1933–December, 1934).]

Misc. Publ. Nat. Agric. Res. Bur. Nanking 1935 : No. 4 : Pp. 20.

The history of the entire organization of this new bureau which entered upon its full activities in 1933 is recorded. Much of its work is devoted to crop improvement in which numerous experiment stations throughout China are co-operating, especially in the research on wheat, cotton and rice.

Wheat investigations comprise a study of the important Chinese varieties of a collection of world wheats, the improvement by a regional survey of existing wheats and their adaptability, tests of foreign varieties, selection, hybridization and breeding for resistance and vernalization.

A similar plan of campaign has been adopted in research on rice, with additional investigations on photo-periodism, field plot arrangement and planting methods.

In the study of cotton, regional tests of Chinese and foreign varieties, selection on a very large scale, hybridization and variety tests have been undertaken.

Potatoes too are undergoing variety tests and hill selection. Blank tests are being conducted with sweet potatoes.

The Department of Forestry is occupied with the problems of seed storage and germination, the improvement of varieties of the Tung oil and Candleberry trees, while methods of planting and Shang Tsun mushroom culture are among the other branches of research that are being developed.

Some of the work mentioned has already been referred to from time to time in " Plant Breeding Abstracts."

951. 633:575(51)
633:575.1:519.24(51)

Shen, T. H.

Application of science to agriculture in China.

Proc. 5th Pacif. Sci. Congr. 1933 : **1** : 573–79.

With the application of the recent discoveries and methods of science to Chinese agriculture active development has begun in may directions and new lines of research hitherto unexplored are being opened up. Genetic and biometrical methods are now being applied to crop breeding ; surveys of plant diseases have been made in Eastern China and the production of disease resistant cereals is receiving full attention.

An account is given of the achievements up to the present in selection for improvement with wheat, rice, cotton, soya beans, kaoliang and millet ; and the methods of breeding cereal crops and cotton and the technique of field experimentation used and finally the results so far attained are discussed.

952. DUCELLIER, L. 633:575(65)
Résumé des recherches et travaux éffectués par le Laboratoire d'Agriculture et la Station d'Essais et d'Amélioration des plantes (Institut Agricole d'Algérie) en 1933. [**Résumé of the research and work carried out by the Agricultural Laboratory and the Station for Experiments and plant improvement (The Agricultural Institute of Algeria) in 1933.**]
Inst. Agric. Algeria 1935 : 7–8.

The work of the institute included the production of new wheats by selection or hybridization and also crosses between wheats and 2 and 4 rowed barleys, variety tests of wheat, barley and oats and the study of the various pedigree lines of barley, wheat and wheat x *Aegilops* crosses.

953. 633:575(89)
BOERGER, A. 633:575.1
La genética en su relación con el problema de las " Plantas más eficaces." (**Genetics in relation to the problem of "the most efficient plants."**)
Arch. Fitotécn. Uruguay 1935 : **1** : 13–31.

After tracing in some detail the fundamentals of the science of genetics, instances are quoted in illustration of its practical application in plant improvement, firstly in the world at large, then with special reference to the Rio de la Plata.

First in importance in this latter respect is the improvement of wheat in regard to productivity and quality. Adaptation to local conditions is the first essential in any successful wheat and the importance of this is particularly emphasized. For Uruguay it is necessary to have varieties capable of avoiding the ill effects of the heavier winter rains and the varieties produced at " La Estanzuela " are all suitable either for very late or for very early sowing. Attention is being given both in Argentina and in Uruguay to wheat baking quality and to the production of rust-resistant varieties, three new varieties of wheat resistant to *Puccinia glumarum* having been recently produced at " La Estanzuela."

In maize the problem consists of extending the zone of possible cultivation towards the south ; flax breeding aims, in addition to creating varieties with increased yield and disease resistance, at the production of a form suitable both for oil and fibre. Success has been obtained in breeding improved strains of oats, barley and soya beans and in the selection of strains of Sudan grass free from hydrocyanic acid, whilst the work on potatoes has been resumed on an enlarged scale.

954. THOENES, H. 633:575:575.42
Ein Beitrag zum Problem der Elitenauslese. (**A contribution to the problem of élite selection.**)
Pflanzenbau 1935 : **11** : 310–12.

The writer deplores the enormous amount of time and labour usually expended by the breeder in the elimination of individual plants in building up new varieties. The numerous criteria generally employed, e.g. number of ears, length of stem, number and weight of grains, thousand corn weight, etc., etc., are all phenotypic characteristics which cannot adequately indicate the genotype ; and in the subsequent stages hundreds of the progeny of plants thus chosen must be eliminated in spite of the care and labour expended in their initial selection. This criticism is shewn to apply especially to beet selection and the writer suggests that both beet and other plants should be selected in the first instance by a general estimate of the desired type by their external characteristics, without elaborate and meticulous measurement of the various components of yield. The ultimate value of the plants chosen will be decided by the results of the progeny tests.

Discussion is invited.

955. 633:575:576.312.32
MÜNTZING, A. 633:575.1:576.312.32
Kromosomforskning och växtförädling. (**Chromosome investigation and plant improvement**).
Skånsk JordbTidskr. 1935 : No. 8 : 115–24.

The results of investigations on the chromosome and their applications in the breeding of various crop plants were summarized in this lecture to Scandinavian agricultural advisory workers.

956. RANCKEN, G. 633:575:576.312.32
Kromosoomitutkimuksen merkityksestä kasvinjalostustyössä. (**The importance of chromosomal investigations in plant breeding.**)
Maataloust. Aikakausk. 1934 : **6** : 73–84.
This paper makes clear how invaluable to the plant breeder is a knowledge of the chromosomal constitution and behaviour of his material.

957. 633:575:578.08(77.4)
DOWN, E. E. 633:575.42(77.4)
The introduction of varieties of field crops free of detectable mixtures or segregations.
J. Amer. Soc. Agron. 1935 : **27** : p. 318.
The measures taken by the Michigan Agricultural Experiment Station to ensure the ultimate purity of varieties raised in their breeding plots are briefly noted. Progeny tests in the field form part of the procedure adopted.

958. KOSTJUČENKO, I. A. 633:575:578.08:581.143.26.03
(**The method of choosing initial material in breeding.**)
Semenovodstvo (Seed Growing) 1934 : No. 5 : 18–21.
In making use of the world collection of varieties for crossing with the local strains, the entire success depends on the choice of the most suitable parental varieties. In the past considerable loss of time has been caused by working with unsuitable parental material. Nilsson-Ehle has shewn that to assess the value of varieties it is necessary to grow them under conditions in which they can complete their vegetative cycle. This can be done in Russia only by the method of vernalization. Lyssenko recommends that the best local varieties should be crossed with those world varieties which in the region in question prove earliest after vernalization.
Experiments are described in which various spring wheats were sown in the vernalized and unvernalized state both at Hibiny, with its continuous day, and at Leningrad with its 18 hour day. The cold treatment made hardly any difference to the vegetative period but the long day accelerated it by 3–5 days. This was accompanied by an increase of 0·6–6·6 g. in thousand corn weight, which is thus attributed to the effect of the long day in accelerating the second developmental stage, the photo-stage.
It is necessary therefore to test the parental varieties of long-day plants under continuous illumination to obtain a true picture of their relative merits. For southern regions they will be tested under reduced length of day.
Different plants of a single variety have shewn different reactions to low temperature. Various varieties of winter wheat were vernalized at a temperature of + 2°C. for 45, 35, 25 and 20 days. Controls were sown at the same time as the experimental plants. Only 12 of the 60 varieties tested shewed clear response to the cold treatment ; some of these moreover reacted only in the case of treatment for 45 days, others only to the 45 and 35 days treatments, certain others again only to 45, 35 and 25 days. In these two latter groups both winter and semi-winter types were detectable amid the plants which came into ear normally. Similarly again on sowing certain varieties in spring, especially certain Chinese and Japanese varieties, it was observed that some plants came into ear normally whilst others behaved as winter or semi-winter forms, whereas after vernalization treatment these same varieties eared and matured normally and uniformly. It is clear therefore that many lines which morphologically are pure, with regard to their developmental stages are definitely heterozygous. This heterozygosity is regarded as being partly responsible for the irregular segregations often observed in characters such as yield, earliness etc. In any case it shews the necessity, in choosing parental forms, of basing conclusions only on the progeny of single plants and not on plants chosen at random from a particular line or variety.

959. WANG, C. M. 633-1.421:519.24
(**Errors in field experiments and theorems involved in their estimation.**)
Ann. Res. Counc. Nat. Univ. Peiping 1934 : Agric. Sci. Ser. 1 : Pp. 72.
A very full account of the various methods that have been put forward for the calculation of the errors of field experiments. Various formulae are described, the Bessel formula, and the modified

form of Love, Sun's probable error of average mean method, Student's method, identified with that of Fisher, and methods based on the analysis of variance. The latter are held to be superior to all others by reason of a sounder theoretical foundation, a simplified process of computation, and the enhanced value due to the Z-test. Love's method of computing the probable error from the variation of check plots is criticised. J.W.

CEREALS 633.1

960. 633.1:576.12:576.312.32
633.15:576.12:576.312.32

BRINK, R. A.

Cytogenetic evolutionary processes in plants.

Amer. Nat. 1935 : 69 : 97–124.

A discussion of chromosome changes which have probably played a part in evolution. Changes in chromosome combinations following hybridization may play some part, as indicated by Clausen's work on *Viola*. A more important result of hybridization from the evolutionary standpoint is the production of amphidiploids. Winge's original suggestion that this might take place has been amply confirmed, and the evolutionary importance of the phenomenon is shewn by Müntzing's synthesis of *Galeopsis tetrahit* and also by the rapid spread of the amphidiploid hybrid *Spartina townsendii*. That reduction as well as increase in chromosome number may follow hybridization has been shewn in *Triticum* and *Avena*. Changes in chromosome number not involving the whole genom are also considered important and Babcock and Cameron have endeavoured to work out the phylogeny of *Crepis* species on this basis. It has been suggested that changes of this nature in chromosome number are fundamentally changes in the number of spindle fibre attachments. The importance of structural changes in chromosomes is not so evident and it seems unlikely that deficiencies can directly influence evolution. Duplications and inversions may possibly have their place in the story of evolution and there are indications that reciprocal translocations are important in this respect in maize and *Datura*.

961. SPRAGUE, R. and FELLOWS, H. 633.1–2.484–1.521.6

***Cercosporella* foot rot of winter cereals.**

Tech. Bull. U.S. Dep. Agric. 1934 : No. 428 : Pp. 24.

An account of the disease and the pathogen and including a table of the reaction of varieties of oats, barley, rye, *Aegilops* and wheat to the disease.

WHEAT 633.11

962. 633.11 Merle

LONG, J., PRADON, R. and CABASSON, F. 634.836 Président Astier

Centre National d'Expérimentation Agricole du Midi " Le Merle." près de Salon (B.–du–Rh.) [**The Southern National Centre for Agricultural Research—Le Merle near Salon (B.–du–Rh.).**]

Bull. Off. Agric. Midi 1935 : No. 53 : 1–22.

Inter alia descriptions are given (a) of two new wheat hybrids recently released from the La Merle station for cultivation—Merle No. 11 (Tuzelle-Allora x Ardito) and No 21 (Tuzelle x Saissette) and (b) of a promising new dessert grape Président Astier discovered among the vines grown at La Merle.

963. PRUZKOVA, M. G. and TALANOVA, V. V. 633.11(47)

(The best varieties of wheat for the non-chernozem zone.)

Semenovodstvo (Seed Growing) 1934 : No. 6 : 15–25.

The relative merits are discussed of a number of varieties tested, including many of the new Soviet varieties, whose origins and characteristics are also briefly mentioned.

964. 633.11:551.566.3

PISSAREV, V. E. 633.11 Tulun ZA/32

(A new variety of northern wheat.)

Semenovodstvo (Seed Growing) 1934 : No. 5 : 32–37.

For the northern regions of the U.S.S.R. early maturity is an essential quality in spring wheats, combined with resistance to frost in late spring and early autumn, and the capacity to ripen at a relatively low temperature. For the extreme north, in addition to these qualities resistance to yellow and brown rust and to mildew is also very necessary. The new variety Tulun ZA/32 has been produced by the Tulun experiment station in East Siberia by selection from Huron, which itself has originated from crosses of Red Fife with Ladoga, a typical north Russian form of the type *rossicum*. Of the various lines selected from the impure sample of Huron received from Washington, ZA/32 was the most productive. In maturity it is less than two days later than Novinka in the district of Leningrad. It is thus placed in the group of mid-early wheats ripening in 95–100 days. Its average vegetative period over a number of years and at different stations was 98 days, compared with 96 for Novinka. In the humid northern zone this period was extended to 100 or 105–110 days but here again Novinka was only 1–2 days earlier. In West Siberia the two varieties ripened together in 107 days. The new wheat has a lower heat requirement than Novinka and so it is thought that the zones of the two varieties will coincide. The original Huron was later than ZA/32, in some places by 4 and even 7 days.

The average yield of ZA/32 over a period of 9 years exceeded that of Novinka by 22 per cent, 14·85 centners as opposed to 9·76. It yielded less than Novinka only in one very cold wet year and at certain stations in some years the excess was as much as 40 per cent and in one case 49 per cent. Yield differences in favour of the new variety were observed also in the Far Eastern zones, where it displayed considerable resistance to fungous diseases. When compared with the original Huron the new variety was generally equal or higher in yield, though in certain years of very high yield it was slightly inferior.

Quality tests shewed ZA/32 to be equal to Novinka, the best of all the northern wheats in quality, in respect of size of grain and litre weight. It is lower in salt and protein content. The flour extraction and loaf volume were slightly higher in some years and slightly lower in others, and this was true of the baking quality in general ; in unfavourable years, especially very wet years, the quality of the new variety was definitely superior to Novinka.

The tillering and early growth are better in ZA/32, in consequence of which it is less damaged by unfavourable, dry spring weather. It is also strong in the straw and less prone to shedding.

965. 633.11:575:551.566.3

PISSAREV, V. E. 633.11–1.524.4(47)

(The breeding principles in extending wheat cultivation northward.)

Semenovodstvo (Seed Growing) 1934 : No. 6 : 3–8.

The whole of the northern belt of the Soviet Union, from its western boundary to the Pacific coast, contains considerable areas where wheat has been grown for centuries. The local races occurring over this enormous stretch of country offer a fund of material invaluable to the Soviet breeder. Among these the so-called Siberian wheats, var. *sibiricum*, constitute a group of particular interest, being characterized by extreme earliness and low heat requirements, thin but firm straw, small vitreous grain and fine, soft and spreading awns. They are prone to shedding and disease but are of extreme value as parents for ultra-early, northern forms. The length of time from sowing to ear emergence diminishes with the approximation of the locality to the north, falling to 47 days in Alaska and 45 at Hibiny in the arctic circle. Their total heat requirement was the same in all localities ; specimens of these wheats succeeded in ripening in localities with an average temperature of only 12°C. Their total heat requirement is from 1,300 to 1,400° compared with an average for spring wheats as a whole of 1,800–2,200°. In favourable years they even ripen on the Kola Peninsula, with a total sum temperature of 1,198° and an average temperature of 10·5°C. Their success in these northern latitudes is partly ascribed to the effect of the continuous light.

These wheats are also characterized, however, by low drought resistance, having apparently originated from the wheats of the humid mountains of China. In suitable regions their yields

are exceedingly high, the average yield of unselected material over the period 1914–1921 in West Siberia and Alaska being 25 centners per hectare.
The other group, var. *rossicum*, is much later in maturity and occurs in the more southerly areas. These wheats differ from *sibiricum* in their larger ears and grain, taller straw and in being from 5–7 days to a month later in maturity. They consist of two distinct types, one hydrophytic, the other definitely drought-resistant, the latter being distinguished by a more vigorous root system and spicules on the leaf.
All the author's selections of *sibiricum* were inferior to the earliest lines of *rossicum* in size of grain and also in drought resistance and yield. They were used however in a large number of crosses and promising hybrids have been obtained free from the parental defects of small grain and shedding.
Many successful hybrids of the *rossicum* group are already known under the names Red Fife, Ladoga, etc., and others have now been made from the zerophytic group, e.g. Leda from Krasnodar, No. 013 from Perm and *caesium* 0111 from the West Siberian station ; also a number of valuable forms possessing extreme resistance to early frost : one of these, Balanka, is already widely grown in West Siberia.
The expedition of 1933–1934 shewed the existence of a large number of promising forms also among the late group of *rossicum*.
The only promising winter form is a pubescent, awnless red-grained *velutinum* from the Baltic shores.

966. WAGNER, S. 633.11:575.061.2:581.46
Ährendichte und Spindelgliedlänge bei *Triticum spelta*. (**Ear density and rachis internode length in *T. Spelta*.**)
Züchter 1935 : **7** : 81–84.

A comparison of the results of measurements of ear density and rachis internode length by means of the formulae :—

$$D = \frac{\text{number of spikelets}}{\text{rachis length in cm.}} \cdot 10 \text{ and } Sp. = \frac{\text{rachis length in mm.}}{\text{number of rachis nodes}} = \frac{\text{rachis length in mm.}}{\text{spikelet number} - 1}$$

with direct measurements shewed that the two formulae gave discordant results and their use is liable to lead to false conclusions. It was found that the density, *D* was strongly influenced by the number of abortive spikelets at the base of the rachis which in turn were much affected by external conditions. It is therefore suggested that the formulae already quoted should be replaced by the following :—

$$D = \frac{\text{number of fully developed spikelets}}{\text{fully developed part of the rachis}} \cdot 10 \text{ and } Sp = \frac{\text{fully developed part of the rachis}}{\text{number of fully developed spikelets} - 1}$$

The results are applicable not only to *T. Spelta* but to all kinds of cereals in which the full development of the spikelets at the base of the rachis is dependent on external conditions.

967. 633.11:575"793":581.9
WADA, E. and AKIHAMA, K. 633.11:581.143.26.03
Relations of the adaptability of wheat varieties for spring-sowing to their geographical distribution and their significance in breeding.
Proc. Crop Sci. Soc. Japan 1934 : **6** : 429–35.

A total of 847 wheats from Japan and many other countries were sown at five different dates between February 25th and April 20th in ordinary fields and the conditions of earing were observed ; ultimately six groups could be established on the basis of adapability to spring sowing. It was found that in cold countries extremes of high and low adaptability prevail, while in temperate climates varieties of low and also high and intermediate adaptability are grown. The Japanese wheats shewed similar tendencies and in passing from the cold to the warm regions varieties of high adaptability increased.
It is concluded that in wheat cultivation varieties of low adaptability to spring sowing should be grown for autumn sowing in cold areas, those of high adaptability, for autumn sowing in warm regions and spring sowing in cold ones, and finally intermediate varieties for intermediate regions.
These principles are important in hybridization and selection work.

968. OEHLER, E. 633.11:575.127
Art- und Gattungsbastarde bei Getreide. **(Specific and generic hybrids in cereals.)**
Naturwissenschaften 1934 : **22** : 851–54.

The substance of this survey which has already appeared in another form (Cf. " Plant Breeding Abstracts," Vol. V, Abst. 308) has been reviewed from time to time (Cf. " Plant Breeding Abstracts," Vol. II, Abst. 41, Vol. III, Abst. 623, Vol. IV, Abst. 382, Vol. V, Abst. 94.)

969. 633.11:575.127.2:576.356
*VAKAR, B. A., KROT, E. B. and BREKINA, L. A. 633.11:575.127.5:576.356
(Studies on wheat hybrids. Cytological memoir.)
Lenin. Acad. Agric. Sci., Siberian Inst. Grain Cult., Omsk 1934 : Pp. 106.

A collective work comprising three articles, as follows :—(1) *Cytological characteristics of the F_7 constant hybrids Triticum vulgare Vill. x T. durum Desf.*

Though the hybrids between these two species are mainly sterile, fertile lines approaching one or other species in character occur in the later generations and it is to these that attention is given in the search for hybrids combining the desirable qualities of both species.

The literature on the subject is reviewed.

The observations were made on plants of the 7th generation from various crosses of *T. durum* x *T. vulgare* carried out and studied by the specialist of the Institute, I. N. Semcenkov. Most of them were segregates from direct crosses between the two species but some were complex hybrids obtained by crossing constant awnless *durum* segregates with pure lines of *T. durum* or *T. vulgare*. All but one were of the *T. durum* type but were awnless.

The pollen was in all hybrids well developed and the ears were well filled with normally developed grains. The reduction division in many pollen mother cells was quite regular but invariably neighbouring cells were observed in which typical irregularities occured, especially in the first division. These irregularities were definitely greater than those occasionally observed in non-hybrid wheats.

The individual hybrids are described in turn and from the meiotic behaviour it is concluded that the nine F_7 hybrids of the *durum* type are not yet completely balanced ; though diakinesis and the polar view of metaphase did not reveal any obvious irregularities, the later stages, and even metaphase in the side view, disclosed clear signs of an unbalanced chromosomal condition. There were nearly always signs of chromosomes passing prematurely to the pole at metaphase and of lagging at anaphase. These irregularities, though slight are quite frequent, and taking into account the presence of fragments in some cases they can in no way be called insignificant.

The telophase of division I was usually regular but even here lagging chromosomes were sometimes observed, probably leading to pollen irregularities ; these however were not detected. All the second telophases observed, though few, were regular and the pollen was invariably normally developed.

Most of the hybrids had bivalents of the closed type, though open ones occurred occasionally. The *vulgare* types, as far as could be judged from the limited material, are very nearly regular. The fact that the hybrids of the *durum* type are not balanced even in the seventh generation may be the reason for the failure to obtain a really fertile awnless *durum* segregate, though Sapehin has reported quite high yields from wheats which shewed considerable meiotic irregularities.

(2) *Cytological investigation of the F_1 of interracial and interspecific wheat hybrids.*

Examinations were made on the F_1 of a cross between a pure line of *T. vulgare lutescens* 062 from Saratov and an awnless *T. durum Talanovi* obtained at Krasnojarsk in 1924 from a cross of *T. durum coerulescens* and *T. vulgare nigrum*. Examinations were also made on other hybrids for comparison, namely (a) *T. vulgare lutescens praecox* x *T. durum hordeiforme* A. 940. (b) *T. persicum fuliginosum* x *T. durum hordeiforme* A. 940. (c) *T. vulgare milturum* 0321 x *T. vulgare albidum* 0721.

***An abridged translation of this paper is on file at the Bureau.**

In type the complex F_1 resembled *T. durum* but was awnless and laxer, just as was hybrid (a) above. The hybrid (b) was intermediate in character between its two parents and (c) had all the characters of *T. vulgare*.
The object of the complex cross was still further to reduce the vegetative period of the awnless *T. durum*. Hybrid (a) was made with the same object in view.
Marked meiotic irregularities were observed in the complex hybrid, seven and often more scattered univalents being present, with up to 14 bivalents at metaphase I. Irregularities were observed also at telophase, in the homeotypic division and in tetrad and pollen formation.
The hybrid (a), a direct pentaploid hybrid, displayed irregularities similar to those of the complex hybrid but less pronounced both quantitatively and qualitatively.
The hybrid of *T. durum* x *T. persicum* was distinguished by comparatively regular meiotic behaviour and pollen formation, definitely more so indeed than hybrid (c), between two varieties of *T. vulgare*. This is an observation of great practical significance, since *T. persicum* is very tolerant of unfavourable growth conditions, is drought-resistant and early—all characters that it is desired to introduce into *T. durum*. This type of crossing is therefore considered to be much more promising than the method of crossing species of different chromosome numbers followed by back-crossing, which in the present experiments at least is seen to aggravate rather than reduce the meiotic irregularities. The authors do not, however, deny the possible value also of the latter type of cross.
(3) *Cytological investigation of the first generation wheat-couch hybrids.*
The literature on the subject is reviewed. The Omsk station in 1932 obtained undoubted hybrids of both *T. vulgare* and *T. durum* with *A. elongatum*, though the large number of crosses effected between *Triticum* and *A. repens* all failed. *Agropyrum* hybrids with members of the 14, 28 and 42 chromosome wheat groups are now known.
The somatic chromosome numbers determined from the root tips were as follows :—
Agropyrum glaucum = 42. *Agropyrum elongatum* = 70. The hybrid *Triticum vulgare* x *Agropyrum glaucum* = 42. The hybrid *Triticum vulgare* x *Agropyrum elongatum* = 56 and the hybrid *Triticum durum* x *Agropyrum elongatum* = 49. The chromosome numbers of the hybrids thus correspond to those expected from the parental numbers.
In the F_1 *T. durum* x *A. elongatum* varying numbers of bivalents, up to 10, were present, these being usually larger than the univalents. The bivalents split and moved regularly to the poles, the univalents passing at random to the poles with or without splitting. The dyads thus contain different numbers of chromosomes. Tetrads were invariably formed and the pollen grains were normal in the early stages, though largely defective when mature. Occasional well-formed pollen grains occurred.
The hybrid *T. vulgare* x *A. elongatum* was similar in behaviour, up to 12 bivalents being observed, though 10 was the usual number. The similarity of behaviour of this hybrid and the preceding one, and the presence again of round about 10 bivalents suggests that 10 of the *A. elongatum* chronosomes conjugate with chromosomes of the A and B genoms common to *T. durum* and *T. vulgare* but not with chromosomes of the D genom specific for *T. vulgare*.
In the hybrid *T. vulgare* x *A. glaucum* again meiosis was similar to the two preceding cases ; as many as 14 bivalents were occasionally observed, 10 or lower being more common. This shews that the remaining seven in both *T. vulgare* and *A. glaucum* are incapable of pairing. It is supposed that these seven in *T. vulgare* again represent the D genom but the examination of the hybrid *T. durum* x *A. glaucum* will provide the final elucidation of the chromosome homologies in the two genera.
This behaviour indicates a much closer relationship between the two genera than has hitherto been suspected and the behaviour of the bivalents and univalents is very similar to that familiar in interspecific wheat hybrids. In intergeneric crosses, e.g. the hybrid *Aegilops ovata* x *T. monococcum* examined by the author, no regular metaphase plates at all occur, no bivalents are formed, tetrad formation is quite irregular and the pollen is defective even in the young stages. Similar pronounced aberrations are characteristic for wheat-rye hybrids, where no more than 1–4 bivalents are formed. On the other hand the pollen of the present *Agropyrum* hybrids often consists of large well-formed grains some of which may be fertile since some of the F_1's are self-fertile. In consideration of this the authors are led to conclude that *A. glaucum* and *A.*

elongatum should be included in the genus *Triticum* rather than *Agropyrum*. Tzitzin has reached the same conclusion on the grounds of the behaviour on crossing. The other species, especially *A. repens*, should remain in the genus *Agropyrum*. Before making a final systematic revision of the genus, crosses of *A. glaucum* and *A. elongatum* with other species of *Agropyrum* will be studied, *A. repens* in particular, and the hybrids which Tzitzin has produced between *T. monococcum* and *A. glaucum* and *A. elongatum*, and which are expected to form seven bivalents, will be examined.

970. KOSTOFF, D. 633.11:575.127.2:576.356.5
(Studies on polyploid plants. V. Fertile *Triticum vulgare–monococcum* hybrids.)
C.R. Acad. Sci. URSS 1935 : **1** : 155–59.

Crosses made between *T. monococcum* L. var. *flavescens* Kcke (2n = 14) x *T. vulgare* Vill. var. *ferrugineum* Al. (2n = 42) in 1931 resulted in six mature hybrids, all more or less morphologically intermediate between the parents but five were sterile and one partially fertile. The five sterile plants shewed 28 somatic chromosomes (21 *vulgare* + 7 *monococcum*) while the partially fertile plant had 35 and is presumed to have originated from the union of a 21 chromosome gamete of *T. vulgare* with an unreduced gamete of *T. monococcum*.

Cytological investigations of the reduction divisions were made only from aceto-carmine preparations. In the sterile hybrids 5–12 bivalents appeared to be present and in the fertile hybrid 7 bivalents from the chromosomes of *T. monococcum* and 5–10 bivalents formed from *T. vulgare* chromosomes. About 65–75 per cent viable pollen was formed. An F_2 raised in 1933 from the fertile hybrid segregated into a variety of forms (including a *compactum* type) and varying degrees of fertility.

In 1934 an F_3 was raised and among the progeny were a number of plants with 28 chromosomes and a normal or almost normal reduction division.

It is assumed that 7 *vulgare* chromosomes have been eliminated from these hybrids which cross readily with *T. persicum* (2n = 28). Such hybrids may be a means of transferring *monococcum* characters to *durum* and *vulgare* wheats.

971. TAYLOR, J. W. and QUISENBERRY, K. S. 633.11:575.127.5:633.14
Inheritance of rye crossability in wheat hybrids.
J. Amer. Soc. Agron. 1935 : **27** : 149–53.

In order to facilitate the breeding of more winterhardy wheats an attempt was made to evolve a technique for obtaining large numbers of a desired F_1 wheat-rye combination. Two methods were used :—(1) Purplestraw, a variety that crosses with difficulty with rye, was crossed with Abruzzes rye and the F_1 back-crossed to Purplestraw. This wheat-rye-wheat type was then allowed to self and the resulting progeny tested for inherited crossability.

(2) Winterhardy varieties (Minhardi and Minhardi x Minturki, C.I. 8034) of low crossability were crossed with a wheat crossable with rye (Chinese) but not winterhardy, to produce hardy types of wheat that would cross with rye. The experiments were done in greenhouses and in the field.

The crossability of Purplestraw with rye was low, a set of only 1.5 per cent being obtained. The F_1 from Purplestraw x rye when back-crossed with wheat gave 2 seeds from some 1,000 pollinations. The two resultant plants showed normal dehiscence and were self-fertile. The progeny of one of these plants consisted of ten individuals all of which were pollinated with rye. Eight of these ten showed crossability and the pollination of the ten gave a set of 19 per cent of seed. Further pollination of the wheat-rye-wheat line with rye gave a crossability of over 30 per cent. Morphologically the wheat-rye-wheat type was like a true wheat, closely resembling the Purplestraw parent.

Of the 20 F_1 hybrids of wheat-rye-wheat x Abruzzes rye two dehisced some of their anthers and one gave a single selfed seed—the only certain instance of these two phenomena in such a cross. From the selfed seed a non-segregating line intermediate between wheat and rye originated. Minhardi and Minhardi-Minturki, C.I. 8034 shewed low crossability with Dakold rye ; but the Chinese variety gave a set of 69 per cent when pollinated with Dakold. The F_1 from Minhardi x

Chinese set no seed and the (Minhardi-Minturki) x Chinese only 1·3 per cent when crossed with rye.
Segregation for crossability, which behaved as a recessive, occurred in the F_2 of the Minhardi x Chinese and the Minhardi–Minturki x Chinese crosses respectively. Only F_2 plants shewing crossability and vigour were continued in the F_3. The lowest crossability in any F_2 line was about 12 per cent and the highest over 80 per cent. Winterhardiness tests of the F_4 lines of these two crosses in 1933–34 indicated that a combination of crossability with rye and winterhardiness had been obtained.
It is concluded that though the numbers of plants used were small, crossability appears to be determined by a main recessive factor, though the possible existence of minor modifying factors must be admitted.

972. . 633.11:575.127.5:633.289
OEHLER, E. 633.11 *Aegilops*:575.127.5:633.289
Untersuchungen an *Aegilops-Haynaldia* und *Triticum-Haynaldia* Bastarden.
(Investigations on *Aegilops-Haynaldia* and *Triticum-Haynaldia* hybrids.)
Z. indukt. Abstamm.-u. VererbLehre 1935 : **68** : 187–208.
The name *Haynaldia villosa* Schur. is preferred by the author to the three other synonyms, *Triticum villosum* (L.) M.B., *Secale villosum* L. or *Agropyron villosum* Lk. because the species in question is quite clearly distinguished by a number of morphological characters from all species of the genera *Triticum, Secale, Aegilops* and *Agropyron*.
H. villosa crosses with all species of *Triticum* and *Aegilops*. In the first case it was used as both male and female parent, in the latter only as the male parent. Fifteen species of *Aegilops* were crossed with *H. villosa* and the average set was 3·55 per cent. There was considerable variation in setting among the individual species but no relation could be established between the set of seed and chromosome number, or time of flowering. Six species of *Triticum* were crossed with *H. villosa*. The average set was 1·62 per cent and the number of crosses was too small for any conclusions to be drawn from the influence of the chromosome number or time of flowering of the parents as to the closeness or otherwise of the relationship between them.
The morphology of the F_1 hybrids is described in some detail and compared with that of the parent species.
In general, in the *Aegilops-Haynaldia* hybrids, *Aegilops* was dominant in the majority of characters and *Triticum* in the *Triticum-Haynaldia* hybrids. In all hybrids only a few *Haynaldia* characters were dominant. The hybrids all flowered with closed anthers. Only one F_2 plant was obtained which appeared to be the product of a back-cross of the *durum* x *Haynaldia* hybrid with an unawned wheat, probably *T. vulgare*.
This plant, whose morphology is described, proved completely sterile.

973. *TRET'JAKOVA, L. 633.11:581.142
(The after harvest ripening of winter wheat in northern regions.)
Semenovodstvo (Seed Growing) 1934 : No. 6 : 33–36.
The germinating capacity of the seeds of a number of varieties of winter wheat was tested at varying periods after harvest, from 5 to 50 days. Marked varietal differences were observed, for instance the rye-wheat hybrid and the variety *ferrugineum* 2411 of the Moscow station gave 60–70 per cent germination on the 5th day, rising to 90 per cent on the 35th. The germinating capacity of other varieties on the 5th day was very low indeed and only reached normal on the 50th day after harvest. Other varieties were intermediate.
The germinating capacity of the seeds was at its maximum at the wax-ripe stage and its minimum at the beginning of the stage of complete maturity. There was no correlation between the moisture content and the germinating capacity at the various stages.

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* A full summary of this paper is on file at the Bureau.

974. JASNOWSKI, ST. 633.11:581.162.5:581.46:575.11
On the inheritance of sterility of spikelets in the ears of wheat.
Bull. Acad. Polon. Sci. Lettres Cracovie 1934 : 89–101.
Crosses made between the two spring varieties of *T. vulgare*, Hildebrandt's bearded which has sterile spikelets at the base of the rachis and Chinese beardless which bears sterile spikelets at the tip of the ear. Two cumulative factors are concerned with the sterility at the base of the ear.
Weight of grains and number of spikelets per ear were independent of the number of sterile spikelets at the base ; number of grains in the spikelets was significantly correlated with the degree of sterility ; there was a negative correlation between the weight of the ears and the number of sterile spikelets. Sterility at the apex behaved as a simple recessive character. The average weight of grains, the number of grains per spikelet and the total number of spikelets were independent of the number of sterile spikelets at the apex and there was no correlation between the weight of the ear and the sterility at the apex.

975. KANIEWSKI, K. 633.11:581.46:575.11.061.2
Über den Einfluss des Ährchentypus auf die Ährendichte beim tetraploidalen Weizen. (**On the influence of the ear type on ear density in tetraploid wheats.**)
Bull. Acad. Polon. Sci. Lettres Cracovie 1933 : 13–28.
Crosses were made between *T. durum* and *T. dicoccum* which have been shown by the author's previous work (see " Plant Breeding Abstracts," Vol. III, Abst. 378) to be recessive for the *P* factor for enlarged empty glumes in *T. polonicum* and the form *polinicoid* which carry the dominant factor *P* ; and the relation of density to the *PP*, *Pp* and *pp* types was studied in the F_2.
From the data the author assumes that the factors for density are inherited independently of *p* and *P* but that the effect of the density factors is dependent on the presence of the factor *PP* and *pp* so that many plants of the *PP* type have laxer ears than those of the most lax *pp* types.
In the same way the effect of the factors for the density and length of the empty glumes is modified by the *Pp* and *pp* factors.

976. HOSONO, S. 633.11–1.521.4(51)
Beitrag zur Kenntnis des chinesischen Landweizen. (**A contribution on Chinese land wheats.**)
Mem. Coll. Agric. Kyoto 1935 : No. 34 : Pp. 11.
Notes are given on the systematic characteristics and the geographical distribution of the wheats represented in 426 grain samples received from various parts of China and grown at the Biological Institute of Kyoto University. There is also a list of the varieties of *T. vulgare*, *T. compactum*, *T. durum* and *T. turgidum* hiterto known in China and comments on some characteristics of the Chinese soft wheats and on the rarity of Emmer wheats in China. A bibliography concludes the paper.

977. BEBENIN, V. A. and KON'KOV, C. G. 633.11–1.524.4(47)
(Local populations of wheat in White Russia.)
Semenovodstvo (Seed Growing) 1935 : No. 2 : 44–46.
Observations were made on a number of local populations of wheat from White Russia and other regions, grown in seven different districts of White Russia. Data are given on the yield. The wheats from the Ivanov region exceeded the standard winter wheat Moscow 02411 in yield by 100·8–152·1 per cent and the standard spring wheat by 102·4–166·3 per cent. Some of the local spring wheats also exceeded the standard *caesium* 0111 and other well-known varieties in yield and they are to be subjected to further investigation.

978. Bogdanov, P. I. 633.11–1.524.4(47)
(The ancient local wheats of Voronesh and Kursk.)
Semenovodstvo (Seed Growing) 1935 : No. 1 : 55–59.
The ancient wheats of the Central Chernozem zone have recently been the subject of study. The spring forms have displayed quite high yields, some of them exceeding the variety *caesium* 0111 of the West Siberian station. They consist of different varieties of *T. vulgare* with very occasional admixtures of *T. durum*. Data are given on the quality of these wheats when grown at different points. Some of them exceed the standard variety in thousand corn weight, others in protein, gluten or oil content or in yield. They also display considerable resistance to rust and are very promising as breeding material.

979. 633.11–1.67:575
Stephanovskii, I. A. 633.11–2.452–1.521.6:575.127.2
(Immunity of wheat in the irrigated conditions of the Trans-Volga.)
Semenovodstvo (Seed Growing) 1934 : No. 5 : 43–45.
Rust resistance is the main requirement in wheats for the irrigated areas and as the varieties of *Triticum durum* are much more resistant than the soft wheats they are recommended for crossing with the latter, followed by repeated back-crossing.
No rust–resistant winter wheats were found.

980. Pesola, V. A. 633.11–2.111–1.521.6:575(47.1)
Über die Winterfestigkeit der Winterweizensorten, auf Grund der Versuchen von der Abteilung für Pflanzenzüchtung der Landwirtschaftlichen Versuchsanstalt. **(On the winter hardiness of winter wheat varieties, from experiments by the plant breeding section of the Agricultural Experiment Station.)**
Suom. Maataloust. Seur. Julk. 1934 : **31** : 315–50.
In connexion with the wheat breeding work of the Station a study was made of the winter-hardiness of 164 sorts and lines of winter wheat including land sorts, forms bred from native wheats and foreign varieties. The experiments cover ten years in South and Southwest Finland.
An analysis of the data shewed that the most winterhardy forms were all Finnish land wheats or lines derived from them, with the exception of one 0s. Ro380 (Punapää) from hybrid line. Moreover in general, as regards winter hardiness, the indigenous improved types and land sorts included some excellent or good types (e.g. Pohjola, Varma and Sampo) ; the native lines and crosses also contained several wheats classed as excellent or good types. The Swedish, German, American, etc. productions, on the other hand, contained no such lines and proved not only inferior to the Finnish forms but had bad or unsuitable as regards winterhardiness.

981. Vatsenko, A. A. 633.11–2.111–1.521.6:578.081
(Evaluation of breeding material by means of artificial removal of the snow.)
Semenovodstvo (Seed Growing) 1934 : No. 5 : 49–50.
The cold resistance of a number of varieties was tested by removing the snow covering for varying periods during the winter. Clear indications of the degree of susceptibility to cold could be obtained by removing the snow for a period of 2–3 weeks during the coldest part of the winter in the steppe zones.

982. Stephanovskii, I. A. and Petropavlovskii, M. F. 633.11–2.112–1.521.6
(The characterization of drought-resistant varieties of spring wheat.)
Semenovodstvo (Seed Growing) 1934 : No. 5 : 38–43.
Different kinds of drought resistance have been seen to exist, some varieties are damaged more by late than by early drought or vice versa, some can tolerate low moisture content of the soil but not of the air or vice versa. It is proposed to make complementary crosses of lines resistant to early and late drought, etc. and for this purpose a thorough study was made of the reaction of a large number of varieties, including four hundred varieties of the world collection of spring wheats. In this way the varieties could be arranged in types according to their reaction. The types suitable for breeding drought-resistant wheats for different regions are indicated.

983. RUSAKOV, L. F. 633.11–2.4–1.521.6(47)
(Diseases of northern wheat and their prevention.)
Semenovodstvo (Seed Growing) 1934 : No. 6 : 30–33.
A brief description of the different types of smut, rust and *Fusarium* attacking wheats in the U.S.S.R. An examination of the varieties most highly recommended for cultivation shewed that these are by no means resistant to disease, with the exception of the variety Moskovskaja 02411, which is highly resistant to *Ustilago* relatively resistant to *Puccinia glumarum, P. graminis* and *Tilletia*, though it is very susceptible to *Puccinia triticina*.
Much further breeding work will thus be necessary before really satisfactory wheats are available.

984. LUKIANENKO, P. P. 633.11–2.452–1.521.6:575(47)
(On the susceptibility of winter-wheat hybrids to *Puccinia triticina* Erikss. during 1932. In connection with the results obtained in breeding for immunity.)
N. Caucasian Breed. Centre, Seed Growers' Ass. Krasnodar 1933 : Pp. 46.
The year 1932 was unusually favourable for the development of brown rust at the Northern Caucasus Breeding Centre and even relatively resistant varieties like Ukrainka were badly infected. None of the pure-line material was thoroughly immune but some of the hybrids displayed a degree of resistance amounting to practical immunity. Data are given shewing the considerable differences in yield in the susceptible and resistant varieties, the former giving 27 per cent less yield than the latter. The adverse effect was also seen in the greatly reduced size of grain in the susceptible varieties and the reduced vigour of tillering.
The highest resistance of all was displayed by two hybrids obtained by crossing selections of winter wheat of the Kruglik station with the American spring wheat varieties Marquis and Kitchener. They excelled Ukrainka in yield, often by 50 per cent and occasionally even by 100 per cent and more in bad rust years.
Some of the resistant varieties were tolerably resistant at the same time to *Puccinia graminis*. Most of the hybrids were earlier than Ukrainka in earing and maturity, many of them yielded grain of high milling and baking quality and one of them at least had grain twice the average in size and at the same time highly vitreous. The stiffness of straw and freedom from shedding in some of the hybrids exceeded that of the parents and all these desirable qualities were combined together in a certain number of the hybrids. Special comment is made upon some of the hybrids which though preserving the spring habit of Marquis also displayed a certain frost resistance.
One of the earliest hybrids obtained by crossing Marquis with the winter wheat *ferrugineum* 013 of the Kruglik station is described as being of especial promise in almost all respects, including the possession of complete mature plant resistance to brown rust ; the hybrid, known as G-622, was superior to Ukrainka in yield in bad rust years, in quality it is also superior and it is further distinguished by particularly high standing capacity ; it is more resistant to shedding and is 4–5 days earlier than Ukrainka, being a frost-resistant alternative wheat in type.
Resistance to smut and other fungi is going to be investigated on similar lines to those here described for rust.

985. ENGELKE, H. 633.11:664.641.016:575
Die Bedeutung mechanischer Sortengemische für die Weizenqualität. **(The importance of mechanical mixtures of varieties for wheat quality.)**
Pflanzenbau 1935 : 11 : 241–50.
Experiments in which the Göttingen technique (Cf. " Plant Breeding Abstracts," Vol. V, Abst. 679) for the determination of quality of wheat variety mixtures was used demonstrated the importance of considering specifically varietal effects, when combining suitable varieties to produce wheat mixtures of satisfactory quality.
In view of the interest which varietal mixtures must have for the breeder, experiments on the possible existence of a relation between the genotypic and the mechanical mixture are contemplated.

986. 633.11:664.641.016:631.524.2:575(65)

La production des blés de qualité en Algérie. (**The production of quality wheats in Algeria.**)

Inst. Agric. Algérie 1935 : 1–16.

The constant demand of millers for baking quality in wheat has led to the introduction of exotic varieties, Indian and Australian being more suited to the Algerian climate than Canadian wheats. Hybrids have also been produced and some are grown extensively, whilst others are still being tested. The following can be recommended as strong wheats : certain hybrids from Florence x Aurore, Pusa No. 4 and No. 422, and as wheats of good baking quality : Baroota, Florence No. 290 and No. 135, and hybrids from Pusa x Florence, Florence x Mahon and Mahon x Pusa.

The great fluctuations characteristic of the Algerian climate make yield and quality very variable, and work is needed to find varieties suited to the various regions.

BUCKWHEAT 633.12

987. 633.12:581.32:576.312
633.12:581.162.4
633.12:576.312.35

MAHONY, K. L.

Morphological and cytological studies on *Fagopyrum esculentum*.

Amer. J. Bot. 1935 : **22** : 460–75.

An account of the ontogeny of the ovule, macrosporogenesis and the development of the macrogametophyte is followed by a description of the processes of pollination and fertilization; the latter occurred between 48 and 60 hours after artificial cross-pollination.

The haploid number of chromosomes was found to be eight.

OATS 633.13

988. RADEMACHER, B. 633.13–2.19–1.521.6:575.1

Genetisch bedingte Unterschiede in der Neigung zu physiologischen Störungen beim Hafer (Flissigkeit, Dörrfleckenkrankheit, Urbarmachungskrankheit, Blattröte). [**Genetically conditioned differences in the tendency to physiological disorders in oats (blindness, grey spot disease, reclamation disease and "Blattröte").**]

Z. Zücht. 1935 : A **20** : 210–50.

The object of the present research was to determine whether genetically conditioned differences existed in the tendency to the non-parasitic disorders, especially the so-called soil diseases.

During the years 1929–1933 the susceptibility to blindness of 111 oat varieties was tested. As the expression of the disease is dependent on a number of external conditions the variation was considerable. However, the tendency and susceptibility to blindness of the individual varieties was very different and heritable. There appeared to be no correlation between slight susceptibility to blindness and any other character.

Eighty-two varieties of oats were tested for their reaction to grey spot disease and marked heritable differences were observed.

No immune varieties were found within *A. sativa* which shewed a considerable range of resistance. Four varieties of *A. orientalis* were slightly susceptible, *A. barbata, strigosa* and *brevis* and *A. byzantina* still less so.

All varieties with a marked tendency to blindness were more than averagely susceptible to grey spot but not conversely.

The Swedish black oats and the early moor oats with their relatives formed groups with a higher resistance which included mostly the dark-grained types. Although for lightly affected soils there exist varieties with a satisfactory resistance, for areas heavily affected the resistant varieties described provide good material for crossing experiments. It is not known whether there is linkage between resistance and other characters.

During 1930–1935 eighty-six varieties of oats were tested for their behaviour toward reclamation disease and heritable differences in the tendency to the disease were observed. No immune forms were found. *A. strigosa* was highly resistant. Among the forms of *A. sativa*

the black moor oats shewed a satisfactory resistance, while all the white and yellow oats tested (with the exception of the P.S.G. Gold oats) and also the black Swedish oats (which were resistant to grey spot) were more or less susceptible. No certain correlation was found between resistance and other characters.
Crosses have shewn that good varieties with resistance to both grey spot and reclamation disease can be produced. Altogether 52 different varieties were tested for their tendency to the chlorophyll defect described as "Blattröte" [literally = red leaf] and shewed varietal differences. There existed a fairly close parallel between their behaviour to the disease and to blindness. The moor oats again shewed themselves resistant.
Finally, a table is given of the varieties tested shewing their behaviour towards all the four diseases investigated. From this it is possible to group the varieties into four classes : (1) more or less resistant to all the disorders, (2) resistant to none, (3) shewing marked differences and (4) of no special interest in this connexion.

989. RĂDULESCU, E. 633.13–2.451.2:576.16:631.521.6
Untersuchungen über die physiologische Spezialisierung des Haferflugbrandes (*Ustilago avenae* [Pers.] Jens.). **[Investigations on physiological specialization of loose smut of oats (*U. avenae* [Pers.] Jens.).]**
Pflanzenbau 1935 : **11** : 295–300.

Inoculations of a test series of eight Rumanian and other varieties of oats with oat smut from thirteen collections obtained from various parts of Rumania shewed that in that country too different races of oat smut exist ; and four races were identified in this investigation.
Black Mesdag and Red Rustproof proved immune to all the Rumanian races of oat smut tested—a finding which further enhances the value of these two oat varieties as parent material for hybridization. (Cf. " Plant Breeding Abstracts " Vol. V, Abst. 348.)

990. HUBBARD, V. C. and STANTON, T. R. 633.13–2.451.2–1.521.6:581.143
Influence of smut infection on plant vigour and other characters in smut-resistant oat varieties.
J. Agric. Res. 1934 : **49** : 903–08.

Three-year experiments with varieties of oats, inoculated with *Ustilago levis*, proved that in the resistant varieties Black Mesdag, Navarro and Markton, in which covered smut was present as a systemic, latent, or non-sporulating infection, exhibited a reduction in vigour, yield per row, the number of plants, panicles and culms per row and plant height. The decreased yield is also attributed to the reduced number of plants in the inoculated rows. In general, smut infection tended to delay heading in both susceptible and resistant sorts.
The influence of early and late seeding on yield is discussed.

991. REED, G. M. 633.13–2.451.3–1.521.6:575.11
Inheritance of resistance to loose smut in hybrids of Fulghum and Black Mesdag oats.
Bull. Torrey Bot. Cl. 1935 : **62** : 177–86.

The progeny generations obtained from four crosses of Black Mesdag by Fulghum were tested up to F_5 for resistance to the Fulghum race of loose smut of oats (*Ustilago Avenae* (Pers.) Jens.). Results in the F_2 generation indicated that resistance was dominant and that segregation according to a 3 : 1 ratio may occur. The behaviour in F_3 was in agreement with the F_2 results, but in F_4 instead of the expected groups of resistant, segregating and susceptible forms, a very large proportion of plants was found to belong to the resistant group. Other instances of anomalous behaviour in F_4 are mentioned but no general differences could be made. In a number of F_5 families descended from ten resistant F_3 progenies (derived from uninoculated F_2 plants) the resistance observed in the F_3 and F_4 generations persisted in the F_5, thus shewing that resistant selections may be easily secured.
The combinations of some morphological characteristics of the parent varieties in some resistant F_5 families is mentioned.
A brief subsidiary investigation of F_3 progenies of one of the above-mentioned four initial F_1 hybrids shewed that all contained plants susceptible to *U. levis*–Fulghum ; the range of infection varied from 4·5 to 85·7 per cent, though as a rule neither Black Mesdag nor the more susceptible Fulghum have given very high percentages of infection.

992. 633.13–2.452–1.521.6:575
MURPHY, H. C. 632.452:576.16:633.13
Physiologic specialization in *Puccinia coronata avenae*.
Tech. Bull. U.S. Dep. Agric. 1935 : No. 433 : Pp. 48.
Thirty-three forms occurring in North America in the 6–year period 1927–32 are described and given a standard numerical description. The seedling reaction of 266 varieties of oats to forms 1, 3, 7, 16, 17 and 18 are described, and also the adult reaction of the same varieties to natural infestations of crown rust in various localities ; Bond and the two Victorias were the only varieties resistant to all six forms. The reaction of 70 gramineous species to the same 6 forms was studied.
From crosses made with varieties resistant to stem rust and the two smuts *Ustilago avenae* and *U. levis*, it is hoped to produce high-yielding agronomic strains resistant to all the four major oat diseases.

993. 633.13–2.452–1.521.6:575.127.2
GORLENKO, M. V. 633.13–2.451–1.521.6:575.127.2
(Rust resistance in the oat hybrids of the Voronesh Breeding Centre.)
Semenovodstvo (Seed Growing) 1934 : No. 5 : 83–85.
The rust resistance of the hybrids of *Avena byzantina* x *A. sativa* (White Tartar) referred to by Leont'ev (see " Plant Breeding Abstracts," Vol. V, Abst. 682) has been studied at Voronesh, where considerable infection was observed on the *A. byzantina* parent as well as on White Tartar, which was heavily infected. Two of the hybrids, Nos. 5/56 and 15/37, were distinguished by their entire freedom from attack by crown rust almost up to the time of ripening. The hybrid 17/30 was also uninfected.
All the hybrids were considerably more resistant than either of the two parents : the *A. byzantina* parent had an infection of 14 per cent whilst the highest infection in the hybrids was 2.68 per cent. More important still is the fact that the hybrids resistant to crown rust were also free from leaf rust, and some of the hybrids combine resistance to crown rust, stem rust and smut. It is thought that a valuable case of mass immunity has been discovered.

994. 633.13.00.14(47)
(Results of variety tests with oats in 1933.)
Lenin Acad. Agric. Sci., Inst. Pl. Ind., Leningrad 1934 : 4 : Pp. 72.
The results of variety tests of 77 varieties of oats at a large number of stations in 27 different localities of the U.S.S.R. are reported. Only one variety Verkhnjač 053 possessed sufficient rust resistance, combined with good grain quality and yield.

RYE 633.14

995. 633.14:575(47.1)
PESOLA, V. 633.11:575(47.1)
Om råg- och veteförädling och dess resultat å lantbruksförsöksanstaltens avdelning för växtförädling. **(On rye and wheat breeding and the results of the agricultural research station's department for plant breeding.)**
Tidskr. Lantm. 1934 : No. 12 : 305–06 ; 1935 : No. 1 : 7–8 ; No. 2 : 27–29.
I. *Rye.* Toivo rye is one of the station's products and was put on the market in 1931 (see " Plant Breeding Abstracts," Vol. III, Abst. 207). A cross between Stjärn and a Finnish land rye has given strains which it is hoped will be an improvement on Toivo with regard to winterhardiness, straw strength and hectolitre weight. Toivo rye is also proving a valuable parent in breeding work.
Other objectives in the breeding programme are briefly mentioned.
II. *Winter wheat.* As an improvement on the existing varieties the department has raised by selection from a land variety Pohjola wheat, very winterhardy and early but leaving something to be desired with regard to straw stiffness and resistance to rust.
A cross between Thule II and a land wheat of the Pohjola type has given Sampo wheat with

good winterhardiness, good standing capacity and rust resistance which has been derived from the female parent, Thule II. Further improvements with regard to baking quality are needed.
III. *Spring wheat.* Sopu wheat from the cross Marquis x Hankkijas Bruna is early ripening, as high yielding as the parent varieties and with a better standing capacity. It appears to be resistant to rust and has a better baking quality than Hankkijas Bruna.
Varieties bred by another Finnish Institute, Tammi, Pika, Pika II and the Svalöf varieties Rubin, Diamant and Fylgia are briefly described.

996. CRASNIUK, A. A. 633.14:575.127.5:633.289
(The hybrid *Secale cereale* x *Agropyrum cristatum*.)
Socialistic Grain Farming, Saratov 1935 : No. 1 : 106–14.

In 1932 a successful cross was made between a plant of the fifth inbred generation (I_5) of Eliseevskaja rye as maternal parent and *Agropyrum cristatum* (L) P.B. var. *imbricatum* (M.B.) Moiss., a wild perennial grass, which particular variety has by Nevskii been regarded as an independent species *A. imbricatum* (M.B.) Roem. et Schult. Only a few grains were obtained. The young plants were in no way distinguishable from the maternal species and on coming into ear all but one of them proved to be rye selfs. The hybrid plant was 2-3 days later in earing but formed four gigantic ears of the *Agropyrum* type though equal to rye in length and density. Flowering was up to ten days later in the hybrid. The stamens developed at first normally but failed to dehisce and the pollen was almost completely sterile.
The hybrid plants are perennial and can be propagated vegetatively with great ease. Attempts to cross the hybrid with the parents in 1933 were not successful, and crosses with spring rye, *A. elongatum*, *Triticum vulgare*, *T. dicoccum*, *T. monococcum* and a *Triticum-Agropyrum* hybrid also failed.
In height the hybrid is intermediate between the two parents, the vegetative organs are more glaucous than in either parent, the pubescence below the ear is present as in the rye parent and tends to be even more pronounced ; the straw is of the rye type in thickness but does not taper at the top ; it is however solid, more so even than that of the *Agropyrum* hybrid. The leaves and ears are pubescent as in *Agropyrum*. The ear is characterized by the presence of 7–8 florets per spikelet on the average, with a range of 3 to 12, in this again resembling *Agropyrum*, the glumes on the other hand being of the rye type, though intermediate in size and asymmetrical as in the *Agropyrum* parent ; the paleae are also intermediate in type, the spicules on the keel being present more or less as in rye ; the length of the awns is intermediate, their type of base being similar to rye. The inner pale is intermediate in size and pubescent as in *Agropyrum*, and the rachis segments, though slightly pubescent, are much less so than in rye.
Thus with the exception of its perennial habit the plant itself is mainly of the rye type while the ear is of the *Agropyrum* type.

997. FAVORSKY, N. V. 633.14:575.127.5:633.289:576.356
(On the reduction division in the hybrid of *Secale cereale* L. x *Agropyrum cristatum* (L) Gaertn. in connection with the question of its sterility.)
Socialistic Grain Farming, Saratov 1935 : No. 1 : 115–25.

An investigation was made of microsporogenesis in the hybrid referred to in the preceding abstract, after ascertaining the somatic number in root tip counts. This was 21 as expected, consisting of 7 rye chromosomes and 14 from *A. cristatum* ($2n = 28$).
Conjugation of the chromosomes occurred in early prophase, 1 to 7 bivalents being present ; only one case of entire failure of pairing was observed and the most frequent number of bivalents was 7. Various types of association are described. Chromosome segregation was of the *Drosera* type leading to the formation of dyads with numbers varying from 7 to 14 or more, owing to the not infrequent division of some of the univalents. This resulted in similar irregularities of the second division and the production of tetrads all possessed of different chromosome numbers. Micronuclei were often formed but failure to divide was very infrequent.
The pollen grains were hence all uninucleate but many contained micronuclei. In the later stages of their development they began to degenerate and all the mature pollen contained few normal pollen grains. Nevertheless the participation of all 7 rye chromosomes in the conjugation indicates a closer relationship between the two genera than had been supposed and the chromosome behaviour as a whole makes it seem not improbable that success in back-crossing should

occasionally be possible, especially when pollinating the hybrid with rye pollen, which should be capable of fertilizing the occasional gametes containing all 7 rye chromosomes.
The type of the bivalents and the fact that their number never exceeds 7 is regarded as sufficient evidence that their formation is due to homology arising from the presence of identical genes and not to a spurious conjugation caused by genes favouring chromosome pairing. Although the number of back-crosses needed to procure an F_2 generation is exceedingly high there seems no reason for doubting that this should be possible when using rye pollen.

998. SCHEIBE, A. 633.14:576.16
Die Verbreitung von Unkrautroggen und Taumellolch in Anatolien (Mit Bemerkungen zum Roggen-Abstammungsproblem). [**The distribution of weed rye and *Lolium temulentum* in Anatolia (with remarks on the problem of the origin of rye).**]
Angew. Bot. 1935 : **17** : 1–22.

The manner of distribution of the types of *Secale cereale* and *Lolium temulentum* infesting wheat fields in Turkey is described. The two weeds are to a large extent mutually exclusive and occur together only in the intermediate zone between the arid section of the country, characterized by rye, and the coastal belt containing exclusively *Lolium temulentum*. Two definite groups of rye forms also occur ; the first consisting of yellow, brown or purple grained, vitreous forms and occurring in the arid alkali table-land of Central Anatolia, the second of green forms confined to the humid slopes of Western Anatolia. It is this latter group which most closely resembles the cultivated rye of Europe, whose origin is therefore traced to the weed ryes of the humid hills of Armenia and Transcaucasia or even still further east. It is thus thought to have entered Europe from the east via the north of Anatolia into southern Russia rather than via Central Anatolia, Asia Minor and the Balkans as is sometimes assumed. The specimens of rye found in Hungary and Moravia, which are more nearly allied to the Central Anatolian steppe type, are thought therefore to be independent of the present cultivated ryes.

999. ÅKERMAN, Å., ANDERSSON, G. and LINDBERG, J. E. 633.14–2.111–1.521.6
Studien über die Winterfestigkeit des Roggens. (**Studies on the winter-hardiness of rye.**)
Z. Zücht. 1935 : A **20** : 137–68.

A number of different varieties of rye were tested in field experiments in Sweden and Finland. Experiments were also made by an artificial freezing method which is described and the results are compared with determinations of the dry matter and sugar content.
Although a division of the varieties tested into two groups, one more and oneless hardy than the other, is clear in all methods used, there is considerable variation as to the relative position of the individual varieties, this being especially marked in the observations made in the field ; it is suggested that winterhardiness is not exclusively dependent on resistance to cold but also on a number of other factors.
Of the two groups, the more winterhardy varieties includes the Finnish and Swedish land races and the other varieties from central Europe and the new varieties bred in Sweden. It remains a problem for the plant breeder to combine the winterhardiness of the first group with the high-yielding capacity of the second.

1000. VALLE, O. 633.14–2.452–1.521.6:575"793"
Untersuchungen zum Anbau von Johannisroggen. (**Investigations on spring rye cultivation.**)
Suom. Maataloust. Seur. Julk. 1934 : **31** : 413–40.

Inter alia varietal differences in the susceptibility of different types of rye to brown rust (*Puccinia dispersa* Erikss.) were found, strains of spring rye being much less affected than the winter sorts, though the latter too varied in their degree of susceptibility. The resistance of certain strains of land ryes (e.g. Savitaipale and Kirchspiel Helsinki), was much higher than that of certain pedigree sorts of winter rye, e.g. Härmär, Svalöfs Improved Wasa rye.
No relation was evident between winter hardiness and resistance to brown rust.
True spring rye is to be preferred for summer sowing because of its inherent capacity for higher yield as compared with winter rye sorts that have not been improved by breeding.

1001. RICHEY, F. 633.15:575
The what and how of hybrid corn.
Fmrs.' Bull. U.S. Dep. Agric. 1935 : No. 1744 : Pp. 14.
A popular account of the methods of production of hybrid maize from pure lines, and the advantages to be gained from growing it.

1002. YASUI, K. 633.15:575.11
(Genetical studies in *Zea Mays* L.)
Bot. Mag. Tokyo 1935 : **49** : 153–62.
The inheritance of yellowed seedlings was investigated by selfing a plant from S8 (Pedigree No. 1322). The seedlings from three ears were all green at germination but a quarter of them gradually turned to an olive colour and died. The cause of this change is not known but, if the yellowing involved in the olive coloration is hereditary, it is thought to be due to a single factor difference with green (*OL*) dominant to olive (*ol*). A similar ratio possibly due to the same gene was obtained in S9 and S10.
Similar monohybrid ratios were found to underlie the inheritance of the recessive character (*e*), non-embryo grains (i.e. grains in which the endosperm was well-developed, but lacked an embryo), the inheritance of split leaves, another recessive condition due to a gene termed (*sp*) and the inheritance of fasciated spikelet due to a recessive factor (*fs*).
In a cross between a white endosperm and a yellow endosperm line a marked difference in the size of the grain was noted in F_4 and the F_5 results clearly shewed that there were three recessive factors (ed_1, ed_2 and ed_3) determining endosperm development.

1003. COLLINS, G. N. and LONGLEY, A. E. 633.15:575.127.5:576.356.7:576.356.5
A tetraploid hybrid of maize and perennial teosinte.
J. Agric. Res. 1935 : **50** : 123–33.
A tetraploid plant resulting from a cross between perennial teosinte (*Euchlaena perennis* Hitch., 2n = 40) and waxy maize (*Zea mays* L., 2n = 20), believed to have two sets of maize chromosomes, being more maize-like than the usual triploid progeny of this cross, had regular meiosis and very few sterile pollen grains. The amount of autosyndesis may be estimated from the percentage of waxy pollen grains produced by this plant or by other *Wx Wx wx wx* plants in the succeeding generation, according to the formula $t = \frac{1 - 6x}{1 - 2x}$, where x = ratio of recessive gametes to all gametes, and t = coefficient of autosyndesis ranging from 1 complete autosyndesis through 0 random pairing to –1 complete allosyndesis. Plants in the F_2 and F_3 progeny had 0, 1, 2, or 4 *Wx* genes in approximately the expected ratios, and the values of t for the 3 generations were : in F_1—t=0.80 $\pm$ 0.06 (s.e.), in F_2—t=0.77 $\pm$ 0.03 and in F_3—t=0.74 $\pm$ 0.05 ; the differences are not significant.
Significant variations occurring in the percentage of waxy pollen from *Wx Wx wx wx* plants and not in that from *Wx wx wx wx* plants, are ascribed to individual variations in autosyndetic attraction, which would not be expected to shew in the *Wx wx wx wx* plants. Correlations between the percentages of waxy pollen and waxy ovules in individual plants supported this hypothesis, correlation being obtained in *Wx Wx wx wx* plants and none in *Wx wx wx wx* plants. There is some evidence that these variations in autosyndesis are inherited.

1004. 633.15:575.25:576.356.2
JONES, D. F. 633.15:581.143.32
Somatic segregation due to hemizygous and missing genes and its bearing on the problem of atypical growth.
Proc. Nat. Acad. Sci. Wash. 1933 : **21** : 90–96.
The expression of hemizygous recessive genes and their effects in somatic segregation are exemplified by instances of mosaics in maize seeds; and evidence is adduced to shew that mosaics are more commonly due to deletions than to non-disjunction or other chromosome irregularities. In pollination experiments considerable differences in the frequency of mosaics were observed

and it appears aberrant chromosome behaviour is more often found when the parents are widely divergent and the chromosomes of one are consequently functioning in unfamiliar cytoplasm.
The result of the loss of the dominant allelomorphs from two chromosomes in the endosperm and its effects in producing abnormal growth in the tissue of the mosaic area and its neighbourhood are discussed.
The resemblance between gall formations and fasciations in plants and atypical growths in animals is referred to and the action of hemizygous recessive lethal genes in somatic tissue, or of hemizygous normal genes or gene losses of corresponding sections of homologous chromosomes are cited as possible causes of such abnormal conditions. (Cf. " Plant Breeding Abstracts " Vol. V, Abst. 616). Similar growth abnormalities occur as a result of light, heat, etc., which cause chromatin losses involving the genes that regulate cell co-ordination.
It is shown that families differ in the frequency of chromosome aberrations ; and inherited differences in the frequency of atypical growths may be due to the fact that viable deficiencies or lethal factors persist in certain families, but without somatic effect until the protecting genes in the homologous chromosomes are lost.

1005. WEATHERWAX, P. 633.15:576.1
The phylogeny of *Zea Mays*.
Amer. Midl. Nat. 1935 : **16** : 1–71.

No reliable evidence has been obtained from geology about the origin of maize and very little from archeology and exploration. Cytology gives little help, but hybridization has shewn a close relationship between maize and teosinte, while maize can be crossed with *Tripsacum* if the mechanical difficulty of the length of style be overcome, though the cross is not very fertile. Morphologically a relationship is seen to exist between the group *Rottboellieae* of the *Andropogoneae* and the *Maydeae*, the only significant difference being that the flowers are perfect in the former and monoecious in the latter. Their respective flowers may all be considered as derived by reduction or abortion of parts from a hypothetical form with paired, two-flowered spikelets, compounded into spikes or racemes. The different degrees of sexual differentiation may be considered essentially physiological and the author suggests that a branch of Andropogonean stock separated into two parts, one leading to monoecism, the other not ; the former gave rise to the *Maydeae*, separating again into two lines, one culminating in *Tripsacum* species, while the other divided to give maize and teosinte. The second part of the Andropogonean stock gave rise to the *Rottboellieae*.
The various forms taken by the ear of maize have often been the basis of theories of its origin, especially with respect to the numerous rows of grains. The author produces objections to the theories which explain this as the contraction of a panicle, twisting of a spike, or the fusion of several spikes and advances the theory that the form of the ear is to be explained in terms of phyllotaxis, capable of modification according to the physiological conditions.
The author gives his picture of the wild maize plant as it was before domestication ; it was probably not well fitted for survival and was only saved from extinction by primitive man's adoption of it, although it may survive to-day in some well-protected isolated parts of tropical America.
Because of the complex interrelationships of the various cultivated forms of maize, he considers it best to regard it as a monotypic genus.
The close relationship between maize and teosinte indicates a common origin rather than that maize is derived from a cross between teosinte and some other hypothetical plant. The latter theory the author regards as unnecessary and the evidence supporting it can be explained in other ways. The differences between maize and teosinte are attributed to the opposite directions taken by natural and artificial selection.
The botanical considerations suggest upland tropical or sub-tropical regions as the place of origin of maize and its utilization by the Mayan, Aztec and Inca civilizations suggests the upland parts of Mexico or Peru. Because of their common origin the range of teosinte should throw light on this problem and considering the need for barriers to bring about the isolation required for their different development, the author suggests that the diversified topography of the plateau region of Mexico and Central America make this a very suitable place.

1006. WERTH, E 633.15:576.16
Ursprungs des Kulturmais. **(Source of domesticated maize).**
Ber. dtsch. bot. Ges. 1934 : **52** : 419–22.
This is a condensed report of a lecture in which from an examination of abnormal inflorescences and other developmental anomalies of maize evidence is advanced to shew that in its phylogeny domesticated maize must have passed through an *Andropogon*, a *Tripsacum* and a *Euchlaena* stage. It is inferred that maize was probably derived from some debased and hybrid form of teosinte and that certain developmental characteristics and peculiarities might be regarded as the signs of atavistic tendencies.
All the various ways in which the ♀ flowers and inflorescence of maize differ from those of teosinte represent economically valuable characteristics and were thus probably either intentionally or unwittingly selected for cultivation by the Indians.
It is of interest to note that, in contrast to the wild teosinte *Euchlaena perennis*, the cultivated form shews less branching of the female inflorescence and furthermore is like the maize plant an annual and has the same number of chromosomes as maize.

1007. CREIGHTON, H. B. and MCCLINTOCK, B. 633.15:576.356.2:575.116.12
The correlation of cytological and genetical crossing-over in *Zea mays*. A corroboration.
Proc. Nat. Acad. Sci. Wash. 1935 : **21** : 148–50.
To support previous conclusions (Cf. " Plant Breeding Abstracts," Vol. II, Abst. 73, Vol. V, Absts. 104 and 696) further data are briefly stated demonstrating that a genetic crossing-over between the genes *Yg-C-Sh-Wx* involves a cytological cross-over between the knob and the interchange point chosen as cytological markers for chromosome 9.

1008. ANDERSON, E. G. 633.15:576.356.2:575.116.4
A chromosomal interchange in maize involving the attachment to the nucleolus.
Amer. Nat. 1934 : **68** : 345–50.
Chromosome 6 is attached to the nucleolus near the end of the short arm by an enlarged reticulate region. The interchange here described is in this reticulate region, which is consequently divided. Cytological examination shewed the interchange to be with the long arm of chromosome 9. The normal chromosome 6 and the interchange chromosome form a common reticulate region and these chromosomes form a ring at diakinesis, leading to a high degree of pollen sterility, 50 per cent normal and 50 per cent sterile pollen being formed.
Homozygous interchange plants are viable and fully fertile.
Linkage studies with *c*, *sh* and *wx* in chromosome 9 shewed the point of interchange to be beyond waxy, the crossing-over between interchange and waxy being 11·6 per cent. In chromosome 6 the order *interchange-y-Pl* was established, *Pl* being known to be about the middle of the long arm of this chromosome. A cross-over percentage of 5 was established between the interchange and *y* and 16 between *y* and *Pl*. The corresponding percentages in the reciprocal cross were 17 and 26 respectively suggesting the suppression of crossing-over in megasporogenesis.

1009. JONES, D. F. and HUNTINGTON, E. 633.15–1.525:575.3(73)
The adaptation of corn to climate.
J. Amer. Soc. Agron. 1935 : **27** : 261–70.
An examination of the evidence for and against the view prevalent in the United States that seed maize brought from a distance will give a lower yield than local varieties leads the writer to deduce that not only has maize a distinct climatic optimum but also its yield per acre is highest near the limit of possible cultivation in cold regions. It is also shewn that maize may be moved

from a less favourable to a more favourable climatic area without a reduction in productivity and usually with a definite gain, and conversely, that most of the reduction in productivity when maize is taken from one region to another is due to less favourable climatic conditions.
The superiority of Connecticut over other states as regards the yields recorded for maize is attributed *inter alia* to its climate which is ideal for the crop at all seasons of the year and not only during the growing season.
The relationships between yield and climate should be investigated by an exchange of maize between widely separated regions.

1010. 633.15–1.557:575:631.811
633.15–1.557–1.525

STRINGFIELD, G. H. and SALTER, R. M.

Differential response of corn varieties to fertility levels and to seasons.

J. Agric. Res. 1934 : **49** : 991–1000.

Data for quantitative evaluations of varietal adaptation to different soils and seasons were obtained by growing hybrid and open-pollinated varieties of maize across four fertility levels in five seasons.
The results from varieties grown in at least three years indicated that the hybrids as a whole were much more productive than the open-polinated varieties but differences between the Iowa hybrids and the Connecticut hybrid, (both from inbred lines), were observed. The former group tended to be relatively productive at all levels and in all seasons, while the Connecticut hybrid varied in years of drought or more humid seasons and was obviously a " good season " variety.
The Iowa hybrid No. 6 had the best yield record in the experiment, being the earliest to mature and ranking first in yield 9 times out of 12, thus shewing that some varieties may give a good yield under a wide range of conditions.
On the whole, differential yield response of varieties, due to different seasons, was consistent, highly significant and much greater than that due to fertility levels.
The view that a variety may be relatively better at low than at high fertility levels or vice versa was confirmed.
Other aspects of differences in varietal adaption are discussed.

1011. 633.15–1.557–1.547.2
633.15–1.557:575
635.67–1.557–1.547.2
635.67–1.557:575

JONES, D. F., SINGLETON, W. R. and CURTIS, L. C.

The correlation between tillering and productiveness in sweet corn crosses.

J. Amer. Soc. Agron. 1935 : **27** : 138–41.

In order to determine whether tillering in sweet maize was an advantageous factor in yield a three years comparison was made of a number of first generation crosses of inbred strains of the Whipple's Yellow variety obtained by four or more generations of selfing. Six of the best inbreds out of about 100 were selected for stalk growth, production of ears and ear type and were crossed *inter se* and on all the other inbreds remaining after the weakest had been discarded. These crosses were tested for three years. After the first trial the poorer crosses were dropped and new combinations made between promising inbreds. From 56 to 295 different combinations were grown during three years and the number of tillers per plant was compared with the total weight of ears and the weight and number of marketable ears.
Data obtained shewed tillering to be a useful characteristic for productiveness in the Whipple type of early maturing sweet maize.
Certain other relations between tillering and productivity in the inbred forms and their progeny are inferred.

1012. 633.15–2.3–1.521.6:575.11
IVANOFF, S. S. and RIKER, A. J. 635.67–2.3–1.521.6:575.11
Resistance of sweet corn to bacterial wilt.
Phytopathology 1935 : **25** : 21–22. (Abst.)
Among over 200,000 plants tested for resistance to bacterial wilt (*Phytomonas stewarti*) by methods of artificial and natural infection, no immune plants were found though there were considerable differences in susceptibility. Hybrid vigour, inherent vigour and time of maturation were all correlated with resistance. Crosses of susceptible x susceptible, resistant x resistant, and susceptible x resistant inbreds indicated that resistance was dominant.

1013. 633.15–2.451.2:576.16:631.521.6
CHRISTENSEN, J. J. and JOHNSON, I. J. 635.67–2.451.2:576.16:631.521.6
Field reaction of varieties and selfed lines of corn to different collections of *Ustilago zeae*.
J. Agric. Res. 1935 : **50** : 47–57.
Comparative investigations were made on the response of about 100 selfed lines and 5 standard varieties of maize of all grades of resistance and susceptibility to mass inoculation in the field with *Ustilago zeae* from various points of the United States. These experiments made it clear that lines of maize resistant to local collections of smut were resistant to collections of widely different origin. This fact should be of use in breeding for resistance, and actually a number of promising crosses produced from resistant or semi-resistant lines have proved more resistant than the original varieties when tested with *U. zeae* from widely different sources.
The absence of a differential response in selfed lines to different collections of smut is interpreted as indicating that the resistant lines used possess some form of resistance other than physiological. Lines of corn had a tendency to become infected at definite sites (ear, sucker, shoot) irrespective of the collections of smut used. Also the different collections did not influence the number of galls formed per infected plant.
Environmental effects and the most suitable method of selecting smut resistant lines are mentioned. The size of smut galls cannot be used as the sole measure of resistance or susceptibility.

1014. JOHNSON, I. J. and CHRISTENSEN, J. J. 633.15–2.451.2–1.521.6
Relation between number, size and location of smut infections to reduction in yield of corn.
Phytopathology 1935 : **25** : 223–33.
Using hybrids, varieties and inbred lines of maize as material a study of smut-free and infected plants shewed that the extent of the reduction in yield of grain depended on the number, size and location of the smut galls. The importance of breeding for smut resistance in maize is therefore obvious.

BARLEY 633.16

1015. 633.16:575.11:581.48
FREISTEDT, P. 633.16:575.11:581.142
Neue Zielsetzungen in der Gerstenzüchtung. (**New aims in barley breeding.**)
Z. Zücht. 1935 : A **20** : 169–209.
The length of resting period of the grain and the amount of germination in the ear were determined in 250 spring and winter varieties by methods which proved satisfactory for testing a considerable amount of material.
Experiments were made on the inheritance of the length of the resting period. The results of crosses between winter varieties shewed that a retardation of germination was a heritable character but an accurate genetical analysis was not possible. From crosses between spring varieties it was clear that the character behaved as a recessive ; in three of the crosses the inheritance was bi-factorial, in one cross monofactorial. There appears to be no difficulty in combining a retardation of germination with other desirable characters. For the brewing industry a fine glume type is desired ; it has, however, been found that there is linkage between

strong straw and coarse glumes and that all the fine-glumed types lodge badly. The naked and hull-less barleys need to be considerably improved before they are economically valuable. Although theoretically these are the ideal type for the brewing industry it has been found that threshing is liable to damage the grain and impair germination. Further researches on this point are needed. For forage, strains of hull-less barley have been bred from crosses between hulled and hull-less which give as high a nutritional content per surface area as the hulled types. In crosses between hulled and hull-less in which hull-less behaved as a simple recessive, the F_1 was intermediate in type. In the F_2 and succeeding generations all degrees of hulledness were obtained. Crosses between hull-less spring barleys with hulled winter types shewed that there was no linkage between the winter type and hulledness.
Other crosses shewed that there appeared to be linkage between smooth awns and susceptibility to winter injury.
Observations on the germination of grains of 40 varieties of hull-less barleys shewed the existence of three types according to the position of emergence of the plumule from under the seed-coat.
A large number of strains were investigated from the point of view of percentage nitrogen, a low percentage being required by the brewing industry and a high one for a forage barley. Crosses were made between winter barleys in the hope of increasing the nitrogen content but as there was very little variation among the parent strains, as was to be expected the progeny also shewed no great differences and their nitrogen content did not surpass that of their parents. As the investigations did not go beyond the F_1 no genetical analysis could be made.
Crosses were also made between spring types and the results shewed that with high and low nitrogen content were heritable characters. No genetical analysis was made.

1016. BLARINGHEM, L. 633.16:575.22
Acclimatation et dégénérescence des sortes d'orges de brasserie (*Hordeum distichum* L.) **[Acclimatization and degeneration of varieties of malting barley (*H. distichum* L.)].**
C.R. Acad. Sci. Paris 1935 : **200** : 26–28.
The author remarks that varieties of hybrid nature frequently tend to shew phenomena of degeneration or even segregation when grown under certain particular conditions. If attention is paid to this possibility there should be no reason why imported varieties should not be maintained in a pure state.

1017. MIÈGE, E. 633.16:575.22
Variations des caractères de grains des espèces élementaires d'*Hordeum distichum* L. **(Variations of the grain characters of the elementary species of *H. distichum* L.)**
C.R. Acad. Sci. Paris 1935 : **200** : 87–88.
The characters of the various elementary species α, β, γ, and δ of *H. distichum* have been observed to be entirely unstable when European varieties are grown in Morocco. It is suggested that all varieties examined were the product of unsuspected hybridization and had segregated as a result of the sudden climatic change.

1018. POPE, M. N. 633.16:575.42:581.44
Fifteen years of selection in six varieties of barley.
J. Amer. Soc. Agron. 1935 : **27** : 142–48.
In order to ascertain whether the spike internode length of varieties of barley could be altered by selection, determinations were made of the mean internode lengths for 10 strains of lax and 10 strains of dense selections from six varieties and after 15 years no permanent change was evident as a result of selection.
In one variety Svanhals in which selection appeared to have been effective the results cannot be attributed to that agency alone since the variety was of hybrid origin.
On a comparison of the internode lengths of the densest and laxest strains in the last year of the experiment, three varieties, Jet, Manchuria and Hannchen shewed no significant trend.
In approximately 35,000 plants studied one mutation for internode length occurred in Deficiens and one for irregularly spaced nodes and a suspected one for internode length in Hanna.

1019. 633.16.00.14(47)
(Results of variety tests with barley in 1933.)
Lenin. Acad. Agric. Sci., Inst. Pl. Ind., Leningrad 1934 : **5** : Pp. 60.
Variety tests were made with twenty-three standard varieties of barley at 240 different points embracing twenty-four different regions of the U.S.S.R. The most promising varieties are indicated.

MILLETS AND SORGHUMS 633.17

1020. Bogdanov, P. I. 633.173:575.42(47)
(A new variety of millet.)
Semenovodstvo (Seed Growing) 1934 : No. 5 : 75–76.
A new variety of millet, selected by the Voronesh station and referred to as 01265, is described, being characterized by increased yield, size and quality of grain. It gives a high yield of vegetative matter and straw and is mid-early, ripening in 88–110 days.

RICE 633.18

1021. Chiappelli, R. 633.18
Le nuove varietà di riso al Campo sperimentale. **(The new varieties of rice from the experimental ground.)**
G. Risicolt. 1935 : **25** : 25–29.
Descriptions are given of Mantova, Varieties No. 238 and No. 252 (selections from a natural cross between Lady Wright and Chinese Ostiglia) and Variety No. 169 a variant of Lady Wright.

1022. Davis, L. L. and Jones, J. W. 633.18 Calady
The Calady rice variety.
U.S. Dep. Agric., Bur. Pl. Ind. 1935 : Pp. 2 (Mimeographed).
This variety has been isolated from a strain derived from a cross between Caloro, a short-grained, and Lady Wright, a long grained variety.
The new production is a medium grain rice with a light golden grain at maturity, and a stiffer straw than Caloro. It matures about the same time as the latter but should be harvested before the grain is fully ripe. The grains are slightly smaller than those of Blue Rose and are hard, clear, oily and of attractive appearance. Calady's superior performance in varietal and nursery plot trials is recorded.

1023. Codd, L. E. W. 633.18:575.11.061.634
A case of chlorophyll deficiency in rice.
J. Hered. 1935 : **26** : 85–87.
At the experiment station, Georgetown, British Guiana, crosses made between the local variety Demerara Creole and three American varieties Mexican Edith, Americano 1600 and Blue Rose produced in the F_2 a small number of chlorophyll deficient plants in the ratio of 63 green : to 1 albino. Demerara Creole is supposed to bear two of the three recessive factors apparently necessary to produce albino while the third recessive is probably contributed by the American varieties (see " Plant Breeding Abstracts," Vol. IV, Abst. 546).

1024. Takahashi, N. 633.18:575.116.1
Further observations on the linkage relation between the factors for endosperm characters and colour of awns in the rice plant.
Jap. J. Genet. 1935 : **10** : 201–09.
Previous work shewed that the factor *U* (starchy endosperm) was linked to *C*, a factor required for red colour in awns or glume tips, with a cross-over value of about 21 per cent. *R*, the other factor necessary for red awns is independent.
The F_2 and F_3 progeny of three crosses *uuccRR* x *UUCCRR*, *uuCCRR* x *UUccRR* and *uuCCRR* x *UUCCrr* shew coupling and repulsion in close agreement with the expected values. The cross-over values based on some 9 to 10 thousand observations are $21{\cdot}833 \pm 0{\cdot}335$ (p.e.) and $21{\cdot}857 \pm 0{\cdot}650$ for coupling and repulsion respectively.

1025. Piacco, R. 633.18:575.24–181.13
L'origine del riso "Nano" ed il suo impiego nell'ibridazione artificiale. **[The origin of "Nano" (dwarf) rice and its use in artificial hybridization.]**
G. Risicolt. 1935 : **25** : 53–63.
A dwarf variety of rice which was first noticed in 1912 is described. It is assumed to have arisen as a mutation. On account of its hardiness, resistance to lodging, earliness and the non-shattering character of the grains it has been used in crossing experiments to add these qualities to some of the cultivated varieties.

1026. Ossewaarde, I. J. G. 633.18:581.143.26.03
Jarowisatie van rijst. **(Vernalization of rice.)**
Landbouwk. Tijdschr., Wageningen 1935 : **46** : 156–61.
A brief resumé is given of the results of Gassner and Lyssenko, followed by an account of the author's experiments with Robarello rice. The seedlings were maintained for two weeks after germination at a temperature of 3–5°C. Another lot was kept at this temperature for five weeks and a control without temperature treatment. The treatments were carried out at such a time that all seedlings could be planted out simultaneously on April 14th, 1934. By April 27th the leaves of the two treated lots had reached a length of 16 cm. while the controls were only 8 cm. Tillering began in the two treated sets on May 9th and on May 15th in the control. The plants of the two weeks treatment were 2–7 days earlier in flowering than the control, the five weeks treatment being intermediate. Flowering was completed more rapidly in the treated plants. The time of ripening shewed similar differences. The yield of grain and of straw were greater in the two weeks treatment by 18 and 14 per cent respectively, but the five weeks treatment resulted in an actual diminution in yield. The yield increase in the shorter treatment was brought about by a greater number of panicles and a greater number of mature grains per panicle ; the grain length was slightly less, resulting in a somewhat lower thousand corn weight.

1027. Ludolf, A. M. 633.18:581.162
Do tempo de abertura da flor do arroz. **(The time of opening of rice flowers.)**
Bol. Minist. Agric., Rio de J. 1934 : **23** : 23–28.
In rice breeding the time of opening of the flower is one of the most important factors and the results of previous investigators are briefly reviewed. Studies have been made on a number of varieties, including those with long, medium and short grains, notes being made of the temperature, sunshine and amount of cloud at intervals of two hours. Observations were made on 131 panicles with 4,095 flowers and based on these a table of flowering is presented. The results shew that sunshine and high temperature favour flower opening, which progresses normally only at temperatures above 25°C.
No variety opened before 10 a.m. or after 5 p.m., the hours from 12 to 2 p.m. having the maximum flowering, with 57·98, 51·86 and 46·88 per cent for the long, medium and short grained varieties respectively. The varieties with short grain tended to flower more uniformly throughout the day, and so a greater number of their flowers opened between 2 and 4 p.m. than in the other types.

1028. Imai, Y. 633.18:581.162.5:537.531
The effect of X-rays on the production of sterile rice.
Jap. J. Genet. 1935 : **10** : 233–36.
An average mutation rate for sterility of 6·39 per cent was obtained by X-ray irradiation of the ears of rice plants. The response varied with the dosage and with the maturity of the plant treated, being greater at microsporogenesis than at earlier stages. 7·18 per cent of the sterile rice plants were mosaics for different degrees of sterility. The percentage of fertile spikelets on sterile rice (excluding the mosaics) shews a bimodal distribution, with peaks at 0–5 per cent and at 40–45 per cent.

1029. Fedotov, V. S. 633.367:575:581.192

(Breeding lupins for freedom from alkaloid.)

Semenovodstvo (Seed Growing) 1934 : No. 5 : 21–24.

The early attempts by N. D. Prjanišnikov in 1924 to select an alkaloid-free lupin failed largely owing to the insufficiently large numbers that could be examined by the then methods of analysis. Judgment by taste was tried by the White Russian station in 1930 but proved impracticable. The method used by Sengbusch (1930) has not yet been published, and has been kept strictly secret. A method has been devised by the Soviet workers however, by the use of a solution of iodine in potassium iodide, which applied to a small fragment of the seed gives a brown precipitate in the presence of more than 0·1 per cent alkaloid. Smaller quantities are detected by using stronger solutions and estimating the density of the precipitation.

By this method two hundred thousand individual plants have been tested at the Institute of Plant Industry, resulting in the selection of over a thousand seeds with low alkaloid content in the yellow lupin. Over a million seeds of *Lupinus angustifolius* were examined but from all these only two populations, from the main zone of lupin cultivation in White Russia, with low alkaloid content were found. Three and sometimes four generations of these lines have now been tested and the low alkaloid content has been retained. One line can be styled practically alkaloid-free, neither the grain nor the plant have the least taste of bitterness and they give no reaction to a test capable of detecting 0·01 per cent alkaloid ; their protein content is equal to that of the common bitter lupin.

Three sweet lines of *L. angustifolius* and ten of yellow lupins are being multiplied up by the Institute of Plant Industry. Common bitter lupins with 21 per cent of oil, compared with the usual 4–6 per cent, have also been discovered. Attempts are now being made to combine this high oil content with freedom from alkaloids. Attention is now being paid also to freedom from shedding, earliness and disease resistance.

1030. 633.367:575:581.192

Svirskii, Ja. N. 633.367:575.11

(Breeding and multiplication of the alkaloid-free lupin.)

Semenovosdtvo (Seed Growing) 1934 : No. 6 : 9–12.

The new " sweet " lupins are useful not only for fodder and silage but also for human consumption. Their great advantage consists in their high yield and protein content and their capacity to grow on sandy soils unfit for other crops.

In the search for these alkaloid-free forms two and a half million analyses have been made in the last two years, as a result of which twelve alkaloid-free plants of *Lupinus angustifolius* were found. The population from which they were obtained, differed in no way from any other population in morphological features. The first line contains only 0·023 per cent of alkaloid ; it differs from the bitter lupin in being attacked by aphis and the maize moth. The second line contains 0·061 per cent of alkaloid and though it has no trace of bitterness is less attacked by aphis ; its seeds are irregular in germination however and suffer from " stoniness." It is as susceptible to the maize moth as line No. 1. The third line contains 0·113 per cent alkaloid and is slightly bitter in the seed and the vegetative tissue ; it is however much more luxuriant in growth and in yield of seed than the first two. It is attacked by the maize moth but not by aphis. The other lines conformed to one or other of these three types as regards alkaloid content.

The sweet lupins were crossed with the earliest large-seeded White Russian types and among the F_2 obtained in 1934 there appeared alkaloid-free types with white flowers, others with pink flowers and with white seeds. The possessiom of such forms considerably reduces the risk of impurity resulting from accidental cross-pollination from the bitter blue lupin.

In a cross of a pink flowered bitter lupin by the blue flowered sweet lupin line No. 1, the F_1 was blue and bitter and the F_2 gave a normal dihybrid segregation of bitter and blue of 36 : 12 : 12 : 4.

Again in a cross of a white flowered, white seeded bitter lupin with line No. 1, the F_1 was also blue and bitter and the F_2 gave a dihybrid ratio of 20 : 6 : 8 : 1. All white flowered plants also had white seeds. It is pointed out that these results differ from those of the German workers, who obtained ratios of 9 : 7.

The most desired characters now are thin seed-coat and non-shattering pods.
The lines already obtained are being rapidly multiplied. Though they are attacked by a variety of insect pests they are said not to be any more susceptible when closely spaced than any other alkaloid-free crops. They are tested for alkaloid carefully every year so as to avoid any possible loss of purity.
For growing them in the greenhouse in winter, lupins have been found to require continuous illumination and a temperature of 20–25°C. by day and 8–12°C. by night.

1031. KUNZ, E. and HOREL, J. 633.367:575:581.192:578.081
Chemická metoda rychlého zjištění obsahu alkaloidů pro potřebu šlechtění sladké lupiny. (**A chemical method for the rapid determination of alkaloid content for use in breeding lupins**).
Ann. Acad. tchécosl. Agric. 1935 : **10** : 95–98.
In separating seeds or strains of the so-called sweet lupin the alkaloid content of even the minutest quantity of material can be determined by the colour of the precipitate obtained by treatment with solutions of potassium iodide.

1032. NOTTBOHM, F. E. and MAYER, F. 633.367:581.192:575:578.081
Der chemische Nachweis von entbittert gezüchteten gelben Lupinen. (**The chemical identification of yellow lupins bred for absence of bitter properties.**)
Landw. Jb. 1935 : **81** : 1–19.
For the control of sweet lupin seed a method has been elaborated for determining the lupinin and spartein content in bitter lupins.
The technique and its application to similar determinations in the sweet lupin are described in detail ; and a modification of the technique is also described that can be used when the amounts of spartein present are very small.
The spartein content of three pedigree strains of sweet lupins was shewn to be 0·0000, 0·0010 and 0·0148 per cent indicating an absence of bitterness that may be represented by the percentages 100, 99·6 and 96·1 respectively.
The significance of the changes in the anabolic products built up by the plant cell that may have been introduced by the process of breeding is mentioned with special reference to the alkaloids ; this problem however fell outside the scope of the investigation.
The establishment of a maximum content of the bitter substances in sweet lupins is suggested.

1033. SENGBUSCH, R. von 633.367:581.192.6:575.11
Entwicklung und Bedeutung der Süsslupinenzüchtung. (**The development and importance of sweet lupin breeding.**)
Der Biologe 1935 : **4** : 33–37.
The importance to Germany of the discovery of the existence of strains of lupins free from alkaloid, here briefly described, has already been pointed out (see " Plant Breeding Abstracts," Vol. IV, Abst. 1003) and the results of genetical analysis given (see " Plant Breeding Abstracts," Vol. V, Abst. 717). Further possibilities for improvements by the production of increased oil content, non-splitting and soft-podded types are reviewed.

ROOTS AND TUBERS 633.4

1034. BERG, K. H. von 633.41:576.356.5
Über Polyploidie in der Gattung *Beta* und bei den Kulturpflanzen überhaupt. (Nachtrag.) [**Polyploidy in the genus *Beta* and in cultivated plants in general. (Supplement).**]
Züchter 1935 : **7** : p. 105.
The work of Scheibe on the sugar content of the wild beets of Anatolia, omitted from the previous article (see Plant Breeding Abstracts V, Abst. 719) is briefly discussed.

1035. OEHMKE. 633.416:575.42:581.43:581.8
Auslese von Futterrüben nach dem anatomischen Bau. (**Selection of fodder beets by anatomical structure.**)
Pflanzenbau 1935 : **11** : 319–20.
From a crop raised from breeder's seed a number of ideal tankard forms were chosen and then subsequently those beets with average sugar content were selected and microscopically examined. Those deemed satisfactory were sown and selection was continued and ultimately their progeny shewed increased sugar content and yield of leaf as compared with the original beet.
Further tests corroborated these results and the author concludes : (1) that by microscopic selection combined with selection on the basis of external form and chemical composition a high quality tankard beet can be obtained ; and (2) that his previous claim that fodder beets can be judged by the anatomical structure as shewn by sections is justified.
Other workers are invited to co-operate by using the microscopic test.

1036. 633.491 Katahdin
CLARK, C. F. and STEVENSON, F. J. 633.491:575.11
The breeding behavior of the Katahdin potato.
Amer. Potato J. 1935 : **12** : 55–59.
A summmary of the results obtained by extensive use of the Katahdin potato by the United States Department of Agriculture in breeding work.
Progenies obtained by inbreeding, open fertilization and varietal hybridization shewed that Katahdin bears one of the complementary factors for red skin colour and a complementary factor for slight russetting. Also three basic complementary factors for flower colour appear to be present.
As regards tuber shape Katahdin appears to be heterozygous for at least some of the factors for this character.
A high percentage of tubers with shallow eyes may be expected in progenies from a cross containing Katahdin.
Evidence of the transmission of resistance to mild mosaic and latent mosaic has been found and the variety also appears to carry two heterozygous factors for resistance to late blight.

1037. 633.491:575
CLARK, C. F. 633.491
Report of Research Committee on potato breeding.
Amer. Potato J. 1935 : **12** : 91–94.
Intended as a summary of potato breeding by American and foreign workers during 1934 and the latter part of 1933. Most of the bibliographical references have already been reviewed in " Plant Breeding Abstracts."

1038. EMME, H. and VESELOVSKAJA, M. 633.491:575
Zur Frage der Bedeutung der Formen von *S. andigenum* Juz. et Buk. für die Züchtung. (**The question of the significance for breeding of forms of *S. andigenum* Juz. et Buk.**)
Züchter 1935 : **7** : 25–29.
A table is given shewing the results in the F_1 of 44 crosses between cultivated varieties of *S. tuberosum* with wild varieties and forms of *S. andigenum* with regard to yield, number of tubers, uniformity and starch content.
The data represent the results of selection based on external appearance and are compared with the results of crosses between varieties of *S. tuberosum*.
The yield of the intraspecific crosses of *S. tuberosum* was not specially high and that of some of the interspecific crosses was not bad ; some however gave a definitely low yield. Intraspecific crosses of *S. andigenum* gave a consistently bad yield. It is considered that Salaman's assumption of two cropping factors represents too great a simplification of a complex inheritance.
The number of tubers of most of the interspecific F_1 plants was considerably higher than that of the crosses among *S. tuberosum*. The large quantity of tubers and the stolon length of the

andigenum forms used in the crosses was dominant almost throughout. Uniformity among the interspecific crosses was, on the whole, poor. There was considerable variation and it is assumed that this is an inherited physiological character of some complexity.
As the hybrids had been selected from external appearances it is probable that many with a high starch content had been discarded and as a result the number of seedlings with a high starch content was small; some of the interspecific hybrids shewed a starch content higher than that of the *tuberosum* hybrids.
All the hybrids shewed the dominance of late maturity characteristic of the *andigenum* tubers. With regard to disease resistance most of the interspecific hybrids shewed resistance to *phytophthora* and to virus. Cooking quality and resistance to lodging was also good in many cases.

1039. Aamodt, O. S. 633.491:575(71.23)
Potato improvement and new varieties for Alberta.
Circ. Coll. Agric. Alberta 1935 : No. 16 : Pp. 9.
A brief account of the methods and aims of breeding and selection of potatoes and descriptions of the origin and chief characters of some new varieties.

1040. Snell, K. 633.491:575.11
Beobachtungen über Vererbung morphologischer Merkmale bei der Kartoffel.
(**Observations on the inheritance of morphological characters in the potato.**)
Angew. Bot. 1934 : **16** : 425–29.
The characteristic anthocyanin pigmentation of the tubers, sprouts, articulations of the inflorescence and central nerves of the leaves in the variety Centifolia has apparently been derived through Early Rose from the American variety Garnet Chili. Many of the varieties that have originated as seedlings of Centifolia are similarly pigmented, whereas others, characterized by white tubers, are lacking the pigmentation in the other organs. Moreover, this characteristic pigmentation is found also in a number of varieties not derived from Centifolia, some of which can however be traced back to Garnet Chili.
The variety Jubel is characterized by red pigmentation of the sprouts formed in the light, the variety Industrie by blue. Of the varieties known to have originated from crosses of these two, five have red sprouts and five blue. Many varieties originating from Industrie share also its tendency to leaf fusion and its yellow tubers flesh. Again, the characteristic appearance of lenticels on the under surface of the sprout formed in the light in Jubel has been transmitted to a number of its descendents, as have also various tendencies to abnormalities of the flower and inflorescence.
In this way much valuable information on the origin of a variety can often be obtained.

1041. *Asseyeva, T. and Nikolaeva, N. 633.491:575.11.061.6
(**Genetic nature of the colouring of potato tubers, sprouts and flowers.**)
Works Pot. Res. Inst. Moscow 1935 : No. 9 : Pp. 107.
The monograph presents the results of original observations on the genetics of colour, together with a review of the literature on the subject. The results of both authoresses are given. The results are described of a number of crosses between varieties of unknown formula and four "detector" varieties whose genetical constitution was first determined. Three varieties with white tubers and pink sprouts were taken as "detectors," namely Ella, Fürstenkrone and Alma, together with one with white tubers and blue sprouts, Sinetsvetka. The analysis of the varieties with colourless eyes leads to the conclusion that tuber colour is governed by the interaction of the factors $D(D_1)$ on the one hand with the basal factors $R(R_1)$ or $P(P_1)$ on the other, though in exceptional cases the presence of a large "accumulation" of either the basal factors or the complementary factors acting alone without the other may cause the development of a certain amount of pigment.
All the genes investigated have been discovered in two pairs Rr and R_1r_1, Pp and P_1p_1, Dd

* **A full translation of this paper is on file at the Bureau.**

and D_1d_1, the duplicate pairs being in all their effects identical. This same tendency to duplication is evident also in studying the colour of the eyes and flowers and can be explained by assuming that the potato is tetraploid. In this case the four genes making up the pair would all be allelomorphic, which would effect their segregation ratios. The material is not sufficient to shew definitely whether this is so, which point could be finally determined only by selfing a monoplex individual such as Sinetsvetka, Ppp_1p_1 and obtaining in F_1 a combination which in F_2 should give a segregation of 15.56 blue : 0.43 pink, whereas in the absence of allelomorphism only blue progeny would be obtained. Such a study is about to be undertaken.

The material now at hand shews the existence also of a factor *E* determining eye colour and also capable of producing tuber colour in certain combinations. In the red tubered varieties with coloured eyes the factor *D* is replaced by *E* and this in combination with *R* gives red tubers with *dark* eyes, whereas *D* in combination with *R* gives red tubers with *colourless* eyes. The cross between Centifolia and Fürstenkrone further shews that the combination of *P* and *E* gives purple tubers with *coloured* eyes, just as *PD* gives purple tubers with *colourless* eyes. *E* thus proves to be a basal factor similar to *D* but with a different distribution effect, its action being extended to the eyes, where in fact its effect is largely concentrated. All the other morphological peculiarities associated with eye colour are also determined by *E*. The segregation for eye colour in the blue tubered varieties with coloured eyes was approximately 15:1, shewing the presence of two heterozygous factors. The products of segregation seem to indicate that these two factors are identical, so that in addition to *Ee* there would appear to be a duplicate E_1e_1. The factors *E* and E_1 are complementary factors, giving purple or red (pink) tubers with *coloured* eyes when present in conjunction with *P* or *R*. This type of coloration is epistatic to the coloration produced by *PD* and *RD*. Without the basal factors, even in the presence of *D*, *E* and E_1 produce only pale pink eyes whilst tubers remain white or are only faintly tinged with pink. However, a large accumulation of these complementary factors $E(E_1)$ and $D(D_1)$ in the dominant condition may apparently produce a pink coloration of some intensity.

The genetical results obtained with certain mottled varieties with large spots further indicates that these contain a complementary factor *M* in place of *D*, which factor instead of self-colour produces flecking or mottling. It differs from the other complementary factors *D* and *E* only in its sphere of action, this being confined to the zone immediately around the eyes. The combined presence of uniform red coloration (*RD*) and flecking (*RM*) gives a form of " latent " flecking in which the tubers are red with darker patches round the eyes. There is a tendency for the large flecked forms to change to small flecked and the latent flecked to " spectacled," which remains unexplained.

Thus the different combinations of these factors have the following effects :—

Red and purple uniform coloration with colourless eyes — *RD*, *PD*
Red and purple uniform coloration with coloured eyes — *RE*, *PE*
Red and purple large flecking with coloured eyes — *RM*, *PM*

Furthermore, the combination of the purple and red colours produces a muddy purple (blackish) coloration and the combination of the uniform and large flecked coloration produces the latent flecking. The complementary factors in the absence of the basal factors have the following effects : *D*, a faint pink tinge (not always) ; *E* and *M*, pink colour of eyes and often pink tinge in tubers. Again, when large numbers of dominants accumulate, these colours may be intensified and approximate to the uniform pink coloration of the tuber with colourless or coloured eyes or large flecking. The order of frequency of occurrence of the different factors is R_1P D_1E_1M and in all cases the homozygous dominant is very much less frequent than the homozygous recessive. Recessiveness for all the factors is however also very rare. The frequency of distribution of the factors is the result partly of the composition of the original material from South America but also of selection, blue tubers being discarded, and some of them may possibly be correlated with physiological characters influencing yield and thus have been subjected to selection. If this proves to be the case the geneticist will be able to give very material assistance to the practical breeder.

An examination of the flower colours of the different groups shews that *P* and *R* act as basal factors for flower colour as well as for tuber colour. Factors *D* and *E* apparently exert no direct influence on flower colour, since many forms with coloured flowers are recessive for these factors.

Flower colour is produced by a complementary factor *F*, different from *D* and *E*, acting in conjunction with *P* or *R*, its action being confined to the flower. The conclusions in regard to flower colour inheritance are thus as follows :
(1) The basal factor *R* giving red tuber colour in combination with *D*, imparts a similar colour (red-mauve) to the flower in conjunction with a complementary factor *F*.
(2) Similarly *P*, which produces blue tubers in conjunction with *D*, gives blue flowers in conjunction with *F*.
(3) Blue-mauve flower colour is produced by the combination of *P*, *R* and *F* and is epistatic to the previous colours.
(4) White colour may be a pure recessive or may contain the factors *P*, *R* or *F* in an isolated and thus latent state.
(5) For all three of the main flower colour factors *P*, *R* and *F* duplicate factors P_1, R_1 and F_1 are known, each pair of duplicates producing identical effects.
There are grounds for supposing that this is to be attributed to the tetraploid nature of *Solanum tuberosum* but the ratios calculated on this basis do not in every case give a better agreement with the observed proportions and the question cannot at present be definitely decided.
(6) The accumulation of a large number of dominant factors apparently accentuates the colour and also changes the shade in one or other direction. Such an accumulation of dominant *F* factors may produce mauve flowers even in the absence of *R*.
(7) The colour of the star is determined by *P* and *R* in conjunction with a further complementary factor *S* which is independent of *F* and differs from it in its sphere of action.
The predominance of coloured flowers among the seedlings with red and blue tubers with dark eyes and of white flowers among those with white tubers suggests a linkage between *E* and *F*. Preliminary data are given in support of this.

1042. HACKBARTH, J. 633.491:581.143.26:575
Versuche über Photoperiodismus bei südamerikanischen Kartoffelklonen.
(Investigations on photoperiodism in South American potato clones.)
Züchter 1935 : **7** : 95–104.

Varieties of *S. andigenum* and *S. tuberosum* from regions of South America between 4½°N.–42½°S. were grown under short and long-day treatment as a test of their photoperiodic reaction. The number and weight of the tubers produced was used as the standard of measurement.
It was clearly seen that there was a definite correlation between the geographical latitude of the varieties and their photoperiodic reaction. The varieties of *S. andigenum* which preponderate in the more northerly parts were short-day forms, further south neutral forms appeared while the varieties of *S. tubersosum* from the island of Chiloe were long-day forms.
The indices, number and weight of tubers proved to be a satisfactory indication of the photoperiodic reaction. The reaction in the majority of cases is a function of tuber number, less so of tuber size ; short-day plants under short-day conditions producing numbers of small tubers. If tuber formation has already begun then alterations in length of day have little effect.
Short-day forms under long-day conditions make much increased vegetative growth, while these forms under short-day conditions remain small and low, shewing a correlation between tuber weight and vegetative growth. In general it can be said that with a twelve hour day the vegetative growth is much reduced in both long and short-day forms but in both cases tuber formation is increased.
A number of clones was tested for two years and in most cases the results agreed satisfactorily. Some other species of *Solanum* were tested. Two clones of *S. Kesselbrenneri* proved to be short-day forms as did also a clone each of *S. goniocalyx* and *S. phureja*. A clone of *S. curtilobum* (Luqui) behaved as a long-day plant.
The importance for breeding work of a thorough systematic testing of the photoperiodic reaction of the South American clones is pointed out and the use of these varieties for purposes of crosses is discussed. Further work is needed on the genetics of the short-day forms.

1043. STEVENSON, F. J. and WHITMAN, E. F. 633.491:581.6.02:575.3
Cooking quality of certain potato varieties as influenced by environment.
Amer. Potato J. 1935 : **12** : 41–47.

The findings of previous workers on environmental factors affecting potato quality are briefly reviewed and the methods used in the present investigation are stated.

The results shewed that the Katahdin, Chippewa, Russet Burbank and Green Mountain varieties grown under some conditions have a relatively high cooking quality but under others their quality may be poor.

The judges were found to have been using different standards, but had been individually consistent in doing so.

The inherent varietal differences were revealed by the fact that a particular variety tended to maintain better quality than another over a wide range of conditions. Evidence of varietal adaption shewed that in order to compare two varieties they must be grown under very similar conditions.

1044. DARLING, H. M., LEACH, J. G. and KRANTZ, F. A. 633.491–2.4–1.521.6:575
Scab resistance in potato seedlings.
Phytopathology 1935 : **25** : 13–14. (Abst.)

Tests of the resistance to scab, (*Actinomyces scabies*) of a number of inbred lines of potato seedlings shewed no relation between resistance and thick or russet skin. No correlation was found between colour of tuber and scab resistance. A study of the histology of normal and wound cork formation indicated that seedlings whose lenticels had the smaller and more compact cork cells were the more resistant.

Susceptible or resistant seedlings when inbred, in some cases produced both susceptible and resistant progeny. The progenies of some resistant inbred seedlings were, however, almost all resistant.

1045. 633.492:581.162.3
JULIANO, J. B. 633.492:581.4:581.3
Morphology of the sweet potato, *Ipomoea batatas* (Linn.) Poir.
Philipp. Agric. 1935 : **23** : 833–58.

A morphological study including the development of the gametophytes, fruit and seed of *I. batatas*. The material was obtained by controlled self and close-pollinations of the Samar Big Yellow variety and by reciprocal cross-pollinations of it with Pirurutung.

On investigating anthesis it was found that the sweet potato is apparently naturally cross-pollinated and that insects play a large part in cross-fertilization.

Extensive pollination experiments shewed that the two varieties used are reciprocally cross-fertile and that Samar Big Yellow is both self and close-fertile to a slight degree in spite of the unfavourable relative positions of its anthers and stigma.

FIBRES 633.5

1046. 633.51 Tangüis : 575(85)
BARDUCCI, T. B. 633.51–2.484–1.521.6(85)
El mejoramiento de la variedad Tangüis. (**The improvement of the variety Tangüis.**)
Bol. Minist. Fom. Lima 1934 : No. 6 : Pp. 28.

The production of the variety is traced, starting with the initiation in 1905 of selection for wilt resistance, in the variety Suave (degenerated Upland) by Don Fermín Tangüis. By 1930 the variety Tangüis so produced occupied 91 per cent of the total area under cotton in Peru. The characteristics of the variety, which combines wilt resistance with other high qualities, agronomic and industrial, are described. The plant from which the new variety arose segregated sharply into two types, one resistant and the other susceptible and the author is of the opinion that it

arose by mutation and that the plant originally selected was a hybrid between the original mutant and the Common Suave, in a field of which it appeared. The comparatively short space of time which was required for its purification indicates that the original plant had mutated in a small number of characters, but all of them in a favourable direction.

In the course of the extension of cultivation of the variety Tangüis it has become hybridized very frequently with the locally grown cottons and this has led to its so-called degeneration, in consideration of which a scheme of controlled seed production and individual plant selection has been elaborated. About 8,000 plants have been studied individually and selected. In 1926, 102 of these were selected for carrying into later generations. These plants displayed marked differences one from the other and all gave heterogeneous progeny which have all therefore been subjected to further selection; when pure lines were obtained crosses were then effected between the different promising lines.

The plan of the work now in hand is outlined. The commercial qualities of the selections were classified by the expert of a well-known firm of cotton brokers. The characteristics of a number of lines selected on account of possessing cleistogamous flowers are tabulated. Several of these were pollinated with various American and Egyptian varieties of normal type, the F_1 of which crosses was intermediate in most characters; the cleistogamous flowers however proved recessive. The yields and fibre of the hybrids were excellent. The flower characters are to be studied in the second generation.

Observations were also made on the progeny of six plants selected because of their unusual high yield and fibre quality from a field of Tangüis in 1932. The progeny of one of the six retained these qualities, the others were inferior and were discarded. The best progeny was further selected and in 1933 some of the selected plants bore as many as 592 bolls, the average being 204·5 bolls per plant for the whole selected progeny, compared with 105·5 for the cleistogamous selections and only 68·1 for the local Cañete. The differences in yield of lint were of a similar order and the product was remarkably uniform. Great hopes are entertained with respect to this variety. Some of the plants are peculiar in having two sympodial branches instead of one in the leaf axil, which is in part responsible for their high yielding capacity. The new variety is 20–28 days earlier than Tangüis under the conditions of the station at La Molina.

The cross of the local by Egyptian cotton, the supposed parents of Tangüis, produced an F_2 of great heterogeneity. Among the types appearing were plants with cleistogamous flowers, sterile plants in a proportion of 10·8 per cent and plants with every possible leaf type. The improvement of Tangüis by means of such crosses seems improbable.

Progeny of the best wilt-resistant plants appearing in infected fields were tested in fields known to be very badly infected. From 115 plants, of both normal Tangüis and the cleistogamous selections, 23 were retained as wilt-free in 1932. In 1933–34 fortnightly observations were made on the progenies of these plants and the most resistant plants were again selected. This work is being continued and the co-operation of the practical growers in the campaign for resistant material is solicited.

1047. PRESSLEY, E. H. 633.51:575–181.12:677.21:578.081

Improving the uniformity of cotton fiber by the use of the Pressley sorter.

Tech. Bull. Ariz. Agric. Exp. Sta. 1934 : No. 54 : 127–53.

Though lint yield must be the main consideration of the cotton breeder, uniformity of lint should also be considered. Having examined the environmental factors affecting uniformity of lint, the Pressley sorter and its use and application to the problem of testing this character in individual plants selected for breeding purposes are described in full.

Selection in 1931–33 with the aid of the sorter has led to the entire elimination of four of the original nine families of cotton used—a fact which suggests that there may be heritable variation in the uniformity of lint and that by the method descibed more uniform strains might be established. It is moreover of interest that the technique when applied to the selection of plants with a high lint index or weight of lint per 100 seeds also resulted in an improvement.

The process is recommended as saving of both time and labour.

1048. ARANGO, R. 633.51:575.1(72.98)
Reportaje sobre la Estacion Experimental Algodonera de la Isla de Trinidad.
(Report on the Cotton Research Station, Trinidad.)
Rev. Agric. Habana 1935 : **15** : 31–38.
An account of a visit to the station and descriptions of the genetical research in progress.

1049. STROMAN, G. N. 633.51:575.11.061.6:581.466
Genetic relations of three genes for anther color in cotton.
J. Amer. Soc. Agron. 1935 : **27** : 208–15.
The interrelations of three genes postulated for anther colour found in what was supposed to be a natural cross of an Upland type, *Gossypium hirsutum*, with a Peruvian type, *G. barbadense*, are described with the ratios on which the hypothesis is based. Of the genes in question two (*P* and *B*) appear to determine a yellow colour and the third is thought to be an inhibitor *I* which suppresses either *P* or *B* when the latter two are not present together.

1050. FENG, C. F. 633.51:575.127.2:576.312
Genetical and cytological study of species hybrids of Asiatic and American cottons.
Bot. Gaz. 1935 : **96** : 485–504.
Two Asiatic species *G. arboreum* L. var. *neglecta* Watt and *G. nanking* Meyen and two American species *G. barbadense* and *G. hirsutum* were used in reciprocal crosses to test the compatibility between Asiatic and American species. Hybrid plants were obtained only from *G. hirsutum* x *G. nanking* and its reciprocal; but the available data were insufficient to determine the difference in compatibility between different species. The results, however, tended to agree with the general observation that crosses in which the ♀ parent has the higher chromosome number are more successful.
Data from pollinations of American plants by Asiatic pollen seemed to suggest that the low percentage of hybrids between Asiatic and American species was not due to retarded pollen tube growth but probably to some incompatibility of the gametes.
Three hybrid plants, A, B and C exceeded their parents in height, number and length of nodes and basal circumference of the stem, and the superior vigour of one hybrid as compared with the others suggested that reciprocal crosses may differ in the degree of hybrid vigour.
The behaviour of a number of morphological characteristics in crosses between varieties of *G. nanking* and of *G. hirsutum* was examined in six other F_1 hybrids and evidence was obtained that reciprocal crosses give the same results even in crosses between species from different groups. These plants, which shewed a mixture of Asiatic, American and intermediate characters, were sterile. The three hybrids A, B and C also proved self-sterile.
In the hybrids the pollen was very irregular in size, rarely burst in water and was mostly abortive, like the ovules.

1051. *NOVIKOV, A. V. 633.51:581.143.26.03
(Vernalization as a method of improving the quality and increasing the yield of cotton.)
Sredaz NIHI, Moscow and Tashkent 1934 : Pp. 46
Yield increases have been obtained on all the vernalized cotton plots, some of which were of an area of 6 hectares and over. These yield increases were obtained even from cotton grown under the most favourable cultural conditions and are almost entirely to be observed in the first picking, i.e. before the beginning of the early frosts, and in many cases the length of the lint was also increased.
Some varieties after vernalization displayed a certain acceleration in the time at which the various developmental stages set in. Other varieties did not react at all, whilst still others reacted negatively to a 20 day treatment and positively to a 15 day treatment. Some varieties

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* A full summary of this paper is on file at the Bureau.

have even given varying effects in different experiments, shewing that the method requires further elaboration.

The technique of vernalization for cotton is described. The seeds were treated for 5, 10, 15 and 20 days, with a control untreated. The treatment consisted in placing the seeds in glass jars at a temperature of 25–30°C. and treated and control plants were sown together on 25th April. The longer periods of treatment depressed the germination, 20 days treatment depressing it by 46–69 per cent, 15 days by 11·4–13·7 per cent. The shorter treatments had no effect on germination and one variety, Acala 8517, was unaffected in germination even by the 20 days treatment. The variety Navrotskii was not accelerated in flower bud formation, Acala 8517 only by 2 days in the 10 and 15 days treatments. Ashmouni gave an acceleration of three days in the 5 day treatment and Pima an acceleration of four days in the 15 day treatment. None of these differences is of any real significance.

The effect of the treatment seems to lie not so much in an acceleration of the inception of the phases of development but in the more rapid completion of each phase. Acala 8517 shews an acceleration in the 5 day and 10 day treatments yet there is an increment of yield in the other treatments of 27·2–30·2 per cent. Pima shews the same effect.

The yields clearly shew that Acala 8517 is the variety with the greatest response, giving an increase of 13 per cent in total yield and 27·2 to 36·0 in first pick. The Egyptian varieties are still doubtful : though Ashmouni was earlier in maturity in the 5 and 10 day treatments and gave a greater first pick, although the total yield of lint was not increased.

The most favourable periods of treatment are 10–15 days for Navrotskii, 15–20 days for Acala 8517, and 15 days for the Egyptians.

A variety test was carried out with promising American and Egyptian cottons, which were treated at a moisture content of 60 per cent for 13 days at 25–30°C. All varieties germinated 2–3 days earlier in the vernalized than in the control series ; in the later stages the varieties differed in behaviour: the Egyptian varieties, which are late in maturity, shewed an acceleration in flowering and maturity of 5–11 days, whilst the earlier American varieties were hastened only by 4 days. Also within the Egyptian group the late varieties were more affected than the earlier ones. This relationship did not hold however for the varieties within the American group, and some of these were even retarded by the treatment.

The varieties that reacted most with regard to earliness of flowering and maturity also gave the greatest increase in yield from the first picking. This was most marked in the Egyptian varieties, where yield increases of 78 to 157 per cent were recorded in the latest varieties Maraad and Pima.

The American varieties shewed much lower yield differences, Nos. 8427 and 8517 giving the most and the yields of the other varieties were actually reduced. The total yields were similar in every way except that the differences were less pronounced, since in the late varieties the second picking was reduced at the expense of the first. This in itself is an advantage, since it affects the quality of the product in favour of the vernalized series.

The lint length and ginning percentage both tended to be higher in the vernalized plants in the American cottons, whilst the Egyptians gave a slightly reduced lint length, though the ginning percentage was increased.

Further experiments were conducted in 1932–33 on early, mid-early and mid-late varieties of Upland cotton and a number of Egyptian varieties. The seeds were vernalized under the conditions indicated by Lyssenko, for 10–11 days. The germination percentage of the treated seeds was somewhat below that of the control, but the early development was distinctly better in the treated seedlings, as was also the height of the plants at the end of May. There was no difference in the number of nodes and the height of insertion of the first sympodial branch was also not appreciably different in the treated and untreated plants. On the other hand the flowering was more uniform in certain varieties in the treated plants, as for instance in Navrotskii and Ashmouni.

The accelerations observed in flowering were generally between 3 and 4 days but amounted to 13 days for Navrotskii and 9 days for Ashmouni. The differences in date of maturity were in many cases greater, amounting to 12 days in Ashmouni as compared with 9 for flowering.

In all pickings the vernalized plants gave an excess over the controls. In these experiments

again the excess in the first picking was especially marked, particularly in the variety 8517. It is pointed out that the effect of the treatment on Navrotskii is much more favourable than the 20 day treatment employed in earlier experiments.
A further experiment was designed to test the effect of keeping the seeds in a dried condition for 20 days after the end of vernalization. The dried seeds were sown on May 10th and the results shewed that the effects of vernalization had not been in any way impaired by keeping.

1052. 633.51:581.162.3:578.08
HARRISON, G. J. and FULTON, H. J. 633.51:581.331.2
Storage of cotton pollen.
J. Agric. Res. 1934 : **49** : 891–96.
The difficulties involved in hybridizing work with cotton and especially interspecific hybrids owing to the lapse of time that may occur between the flowering of the plants chosen as the female and male parents respectively can, it is believed, be solved by pollen storage.
Three methods of storing pollen of the Pima variety are evaluated. The best and least laborious method appeared to be by refrigeration of the flower gathered early on the day of anthesis. Tests with periods of 2, 3, and 4 days shewed that each additional day of storage resulted in a material reduction in the number of successful fertilizations.

1053. 633.51–1.557–1.421(51)
LOVE, H. H. 633.51.0014(51)
Directions for cotton improvement in China.
Sp. Publ. Nat. Agric. Res. Bur. Nanking 1934 : No. 7 : Pp. 96.
This paper concerns itself almost entirely with the comparison of varieties in yield tests, and with the experimental and biometrical technique to be employed. The suggestion is that the material produced by the plant breeder should go through a systematic series of trials, graduating from the single row trials, without statistical analysis, using the first small amount of seed, to the advanced test stage where three row blocks of each strain are replicated in the field with a check every third block. In the advanced stages deviations from a " theoretical " check based on the yields of the two adjacent checks are calculated for each strain, and a probable error applied to these deviations which is worked out from the variation of the check yields among themselves. The alternative method in the advanced test consisting in arranging in randomized blocks is described, with no indication, however, as to which method is to be preferred. J. W.

1054. WATKINS, G. M. 633.526.43:576.354.46:576.353
A study of chromosome pairing in *Yucca rupicola*.
Bull. Torrey Bot. Cl. 1935 : **62** : 133–50.
The chromosome pairing recorded by other workers in the divisions of somatic nuclei in *Yucca* sp. is confirmed and the paired relationship of chromosomes is shewn to be a general one, applicable to all somatic cells in the adult plant.
In *Yucca rupicola* evidence of chromosome homology as indicated by pairing was found in root tips, ovarian tissue and young embryos, but not in endosperm nuclei.
The problems of when and how the assortive mating of the chromosomes occurs and the rapidity with which the phenomenon takes place is discussed with reference to various organisms.

1055. NILSSON, H. 633.584.3:576.16:575.127.2
Die Analyse der synthetisch hergestellten *Salix laurina* (**The analysis of the synthetically produced *S. laurina*.**)
Hereditas, Lund 1935 : **20** : 339–53.
In order to provide further evidence for the origin of the synthetic species *S. laurina* from the cross *S. viminalis* L. x *S. caprea* L., *S. laurina* was crossed with *S. phylicifolia*. From among the progeny, which were mostly intermediate, was one markedly variant individual which is fully described and named *S. superlaurina*. The data concerning the genom constitution of this new form and of the original *S. laurina* are analysed and discussed.

1056. 633.61 Co 281
633.61 Co 290

MEYER, A. C.

As canas de Coimbatore. (**The Coimbatore canes.**)

Rev. Agric., S. Paulo 1935 : **10** : 3–7.

Among the various canes tried out at the Experimental Station of Piracicaba the Coimbatore seedlings have proved particularly successful, especially on sandy and dry soils, and their early maturity and disease and cold resistance are also strongly in their favour. Co 281 and Co 290 have given the highest yields, the former variety having frequently outyielded P.O.J. 213, though lower in sugar content. The second is suited to slightly better soils and has a higher sugar content. It has also outyielded P.O.J. 213 and is expected to have a great future.

1057. 633.61 P.O.J.36
633.61:575.252

P.O.J. 36 : utilisima variedad de caña. (**P.O.J. 36, an extremely valuable cane variety.**)

Rev. Industr. Agric. Tucumán 1934 : **24** : 79–83.

A brief description is given of this variety and its numerous merits and of two of its bud mutants, P.O.J. 36–M and Paz Posse. The latter is superior in yield both of cane and of sugar and its cultivation is extending both in Tucumán and in other countries.

1058. BISSINGER, G. H. 633.61:575(91.4)

Cane Breeding Department.,

Rep. Res. Bur. Philipp. Sug. Ass. 1932/33 : 35–67.

The report of this Department summarizes the detailed information given in the Monthly Reports. Five classes of seedlings are under observation ; C seedlings of the year 1929–30, E seedlings of the year 1930–31 ; E seedlings, the progeny of POJ 2878 selfed selected as ratoons, F seedlings of the year 1931–32 and special parents selected from earlier seedlings for use as parents. Selection is largely based on a Brix x weight of stool ratio. A special terminology is used, thus :— as a parental designation the lettering used is J for POJ 2878, N for New Guinea 24A, B for Badila and H for H 109, JBB, thus indicates (POJ 2878 x Badila) x Badila, and 29JB33 seedling 33 of the cross POJ 2878 x Badila made in the season 1929.

Detailed determinations are given of stalks per stool, diameter of stalk, weight per stool, Brix and Brix x stool weight rating. The last is a relative measure used to compare different seedlings of the same standing. Diameter of stalk shows little variation from year to year but there is a very large drop in number of canes per stool from the first to the second year and, consequently, in the weight per stool.

Economic circumstances emphasize the importance of the sugar content and, in this connection, it is satisfactory to learn that the Brix of the E seedlings was 9 degrees better than the Brix of the C seedlings, both being measured in the second year, and that the Brix of the F seedlings is, in the first year, 1·8 degrees better than the Brix of the E seedlings.

The results of parental influence indicate that POJ 2878 and Badila crosses are likely to form the most valuable parents.

The Report is profusely illustrated with tables and diagrams. H.M.L.

1059. LENNOX, C. G. 633.61:575(96.9)

The regional variety stations in the seedling selection program.

Hawaii Plant. Rec. 1934 : **38** : 176–85.

A record is given of the performance of seedlings in the different selection stations comprising the scheme, each station being in an area with a different standard cane. The results shew P.O.J. 2364 to be a very efficient parent for short cropping purposes. In judging the seedlings, those which outyield H 109 are further selected on the basis of average juice quality, ratooning ability, shading-in characteristics, tasseling tendencies, ability to form suckers and tolerance of diseases. The crosses of P.O.J. 2364 produced the greatest number of promising seedlings of this type.

Few varieties excelled Yellow Caledonia in regions suited to this variety and those that did again issued mainly from crosses of P.O.J. 2364.

In comparison with P.O.J. 36 the hybrids from the cross Uba x H 456 were the best. Hybrids of various parentage were chosen on account of resistance to eye-spot.

1060. 633.61:576.16(59.7)
GUILLAUME, M. 633.61:575.242
Les variétés de canne à sucre de l'Indochine—nomenclature—origine—répartition—mutations. (**The varieties of the sugar cane of Indo-China—nomenclature, origin, distribution, mutations**).
Bull. Econ. Indochine 1934 : **37** : 1146–53, 1315–16.
An attempt is made first to clear up some of the confusion in the nomenclature of varieties of sugar cane in Indo-China, and then to outline the history of the introductions of various types of cane into that region in which sugar cane was probably unknown to the original inhabitants. A number of abnormalities and hereditary variations observed in the local cane varieties and attributed to mutation are briefly described. The importance of bud mutation as a possible source of new types of value for cultivation is mentioned.

1061. 633.61:581.162.04:575
YAMASAKI, M. and NAKAMURA, M. 633.61–2.19–1.521.6
The resistance to the chlorate toxicity of sugar cane varieties in relation to their arrowing tendency.
J. Soc. Trop. Agric. Formosa 1934 : **6** : 413–16.
In the twenty-one varieties tested pronounced differences were found to exist in arrowing tendency (as measured by its earliness and frequency) and also in resistance to leaf injury by a solution of potassium chlorate. There was a certain amount of correlation to indicate that highly resistant varieties tend to arrow less frequently.

1062. 633.61.0014(96.9)
LENNOX, C. G. 633.61:575(96.9)
Review of 1933-1934 variety tests.
Rep. 13th Meet. Ass. Hawaii. Sug. Techn. 1934 : 61–68.
There are here given the results of replicated comparisons between the newer canes introduced into Hawaii, or bred there. The main conclusions drawn from these comparisons are alone noted here.
POJ 2878 is superior to H 109 one of the standard canes, where the latter is not completely at home and, in all cases, reduces labour costs, being quicker in forming a cover. On the Hilo coast, both in long and short-cropping, it secures a gain over Yellow Caledonia by virtue of better sugar rather than heavier tonnage. Evidence from the Hamakua and Kohala Districts in comparison with POJ 36 indicate that it will compete favourably under long-crop conditions in the unirrigated belt.
25 C 28 (Yellow Caledonia x H 109), prominent on Maui, loses much of its gain in weight over H 109 from poor sucrose content.
26 C 189 (Yellow Caledonia x H 109) owes its value to high resistance to eye-spot.
28–1234 (POJ 2364 x 26 C 270) is characterized by rapid early growth which has been continued to the second ratoons.
28-1864, a sister plant to the last, is of faster early plant growth but less vigorous in the second season.
28–3540 (Yellow Caledonia x H 190 [Sic? 109]), owing to its complete immunity to eye-spot, is spreading widely in the lowlands of the Kekaka Sugar Co.
28 Q 2873 (UD 88 x H 109) is one fourth Uba and has been found especially suitable on shallow, less fertile areas.
Co 290, Co 213 and Co 281 are all under test and show indications of being valuable canes under special conditions.
US 996 (Kassoer x Indian Cane ?) germinates rapidly, shades in quickly and is particularly suited to poor knolls of Hamakua and Kohala Districts. H.M.L.

1063. 633.63(47)
633.63:575(47)

(New regions of beet cultivation.)

Trans. (Trudy) Cent. Res. Inst. Sug. Ind., Moscow 1934 : No. 17 : Pp. 216.

A collective work comprising articles by different authors on various aspects of the cultivation of sugar beet in new areas. Soils, climate, fertilizers and cultural operations are the aspects mainly dealt with, breeding and genetic work being retained for a separate communication. In the section on variety tests with a number of recognized varieties and new selections the yields of the best of these are given, the maximum being 386·7 centners per ha. from a variety produced by the Kharkov station. The order of the varieties in regard to sugar content was different and the best varieties from the point of view of yield of sugar per hectare were those from the Tetkino Station yielding 32·16 per ha. and from the Kharkov station yielding 32·14.

The report of the North Caucasus experiments contains a two-page reference to the breeding work. Serious defects of the North Caucasus beet at present are low sugar content, low quality and too high content of non-protein nitrogen. The " First of May " Station has established a correlation between the depth of coloration of the tissue on crushing and the content of noxious nitrogen. Selections are now being based on this principle and the compositions of a number of lines so selected are tabulated. The best of these lines have 21 per cent of sugar and as little as 0·0685 of noxious nitrogen.

Selection is being carried out for lines which do not cease growth and shed their leaves, with consequent loss in sugar content, during the period of extreme drought at the end of July. Certain lines considerably better than the average in this respect have been obtained.

1064. 633.63:575(43.7)
633.416:575(43.7)
633.63–1.521.1(43.7)
633.416–1.521.1(43.7)

*Soucek, Y.

Das Vorkommen fabrikativ Minderwertiger Rüben in der angelieferten Zucker Fabriksrübe. **(The occurence of inferior beets among the supply of factory beet.)**

Mag. Sug. Ind. Czechoslovakian Repub. 1931/32 : **56** : No. 18/19 : 221–46.

Primarily intended to instruct the sugar refiner how to identify and ensure pure beet seed and roots, this paper deals mainly with the economic and practical issues, including laboratory and field methods of identification. Certain observations are, however, of genetic interest.

One method of testing the varietal purity of sugar beet seed is by the proportion of red and yellow seedlings, each variety displaying a characteristic proportion which can, however, be altered by breeding operations. Yellow hypocotyl is recessive to red and can therefore be increased by selection. Also the known varieties of beets have usually come from a mixture of different families, and the proportions of red and yellow seedlings may vary greatly in one variety but not in another.

Coloured beets of various shades may occur among sugar beets as a result of chance hybridization and the breeder's aim in Czecho-Slovakia is to reduce the percentage of coloured beets to a minimum, though the existing average admixture is only 0·1 per cent. Legislation too prescribes the growing of certain cross-pollinating un-improved plants in the vicinity of élite seed.

The F_1 hybrids between sugar beet and fodder beet resemble the sugar beet in their shape and relatively high, though intermediate, digestibility, more or less closely, according to the parent varieties crossed. In weight this hybrid is superior to the sugar beet and abnormally large weights may be obtained. Digestibility being dependent on anatomical structure of the root, there is therefore a relationship between shape and digestibility. The wide range of variation that may be expected in shape, colour, weight and digestibility in the F_2 is mentioned.

A ratio of 3 : 1 (composed of 54·6 per cent red : 18·5 per cent yellow : 26·9 per cent colourless) is cited for external skin colour in a sugar beet x red fodder beet cross.

Colour was apparently independent of digestibility ; but on the other hand beets with a higher

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* A full translation of this paper is on file at the Bureau.

percentage of sugar generally retained the shape and anatomy of the sugar beet type, while beets with a low percentage of sugar were more like the fodder beet.
An instance is also mentioned in which a fodder beet x sugar beet hybrid gave progeny like the fodder beet but completely white.
The very high degree of digestibility, which is one of the most important distinguishing marks of the sugar beet, is a varietal character, though subject to environmental modification. Another varietal character, viz. the number and density of the rings of vascular bundles in the root, can also be used to distinguish sugar, semi-sugar and fodder beets. The number of vascular bundles is relatively highest in the sugar beet, and higher in the semi-sugar than the fodder beet. The colour of the heart too differs in the sugar beet and semi-sugar beet, the former shewing a much higher percentage of yellow hearts in the comparison recorded.

1065. DECOUX, L. 633.63:575.42
Possibilités nouvelles d'amélioration de la betterave sucrière. (**New possibilities of the improvement of sugar beet.**)
III^e Cong. Int. Techn. Chim. Ind. Agric. Paris 1934 : Q4-B., Pp. 12.
A full report of this paper appeared in the Publ. Inst. Belge Amélior. Better. 1934 : **2** : 79–98 (See " Plant Breeding Abstracts," Vol. V, Abst. 425.)

1066. MUNERATI, O. 633.63:575.42
De l'insuffisance des doctrines actuelles de génétique pour l'explication du mécanisme de l'hérédité de la betterave à sucre. (**The inadequacy of the present theories of genetics for the explanation of the mechanism of the heredity of the sugar beet.**)
III^e Cong. Int. Techn. Chim. Ind. Agric. Paris 1934 : **1** : Q4-A., Pp. 7.
This paper appeared also in the Publ. Inst. Belge Amélior. Better. 1934 : **2** : 73–78. (See " Plant Breeding Abstracts," Vol. V, Abst. 427.)

1067. 633.63:581.143.26:575
CHROBOCZEK, E. 633.41:581.143.26:575
A study of some ecological factors influencing seed-stalk development in beets (*Beta vulgaris* L.).
Mem. Cornell Agric. Exp. Sta. 1934 : No. 154 : Pp. 84.
Environment was found to decide whether the hereditary tendency to premature seeding in beets should be expressed.
The results reported shew the futility of attempting to determine whether bolting in biennial plants is a dominant or recessive character without taking fully into account the environmental conditions. The findings of other workers on the genetic basis of bolting are stated.
In several of the experiments reported in the present paper two crops of seed were obtained from the same plant.
A four-page bibliography is appended.

1068. 633.63:581.4.03:575
HAAN, K. de 633.63–1.556.4:575
De loodrecht gerichte trekkracht noodig om een biet uit den grond te trekken, een nieuwe eigenschap ter onderscheiding van suikerbietenrassen. (**The vertical force required to pull a beet out of the ground—a new character for distinguishing sugar beet races.**)
Meded. Inst. Suikerbiet. Bergen-o.-Z. 1934 : **4** : 149–58.
Using an apparatus like a corkscrew of steel wire attached vertically to a lever with a dial on which the force exerted is recorded, tests were made with a number of races of beets.
Wide varietal differences were found in the vertical force required to raise the different types of beet and these differences were remarkably constant during the years of the tests.
The character thus identified appeared to be correlated with the shape of the roots, the ideal long, smooth form or a variety with numerous lateral roots requiring a much greater force than squat beets with no tap roots.
The differences were confirmed by the data obtained from ordinary field workers.

1069. SOLOV'EV, G. M. 633.689
(*Crambe Kotschyana* **Boiss.—a new desert crop.**)
Semenovodstvo (Seed Growing). 1934: No. 5: 85–86.
A suggested new source of starch, 32–34 per cent of which is contained in the roots of this plant from the semi-deserts of Turkmenia and Tajikistan. Preliminary experiments indicate the possibility of taking it into cultivation.

STIMULANTS 633.7

1070. FRIMMEL, F. 633.71:575(43.7)
Die Aussichten der neuen Tabakzüchtungsmethoden in unseren Verhältnissen. (**The prospects of the new methods of tobacco breeding under our conditions.**)
Časové Otáz. Zeměd. 1934: No. 43: 43–50.
Among the aspects of tobacco breeding mentioned in this paper are seed raising, methods of selection, heterosis and its practical applications, hybrid sterility, the sources and utilization of plant material for producing pure lines for ultimate crossing. Attention is also directed to the necessity for increasing yield, improving the quality in accordance with the different requirements for wrapper, filler and other leaf types and for disease resistance investigations on a large scale.
In some preliminary comments on the physiology of growth in its relation to leaf shape the genetic study of leaf growth is stated to be under way.
The establishment of an institute in Czecho-Slovakia for tobacco investigations and a breeding station is suggested and the functions of the latter are defined.

1071. LAMMERTS, W. E. 633.71:575.127.2:575.129
Derivative types obtained by back-crossing *N. rustica-paniculata* to *N. rustica*.
Z. indukt. Abstamm.-u. VererbLehre 1935: 68: 417–35.
The cytogenetics of the hybrid *N. rustica* x *paniculata* back-crossed to *N. rustica pumila* have already been described (see " Plant Breeding Abstracts," Vol. I, Abst. 562 and Vol. III, Abst. 256). Continuous back-crossing to *pumila* resulted in a number of derivative types, highly fertile and distinct from each other and from *N. rustica pumila*. Cytologically, these types were found to conform to Kihara's scheme.
A genetical analysis of eleven of the derivative types shewed that seven behave as dominant Mendelian units, two as recessives and there were two in which the numbers of dominant and recessive characters made analysis as yet impossible.
A certain number of chromosome variants occurred among the true breeding types described.
Possible explanations for the behaviour of the derivative types are discussed and the interaction of chromosome segments transferred from *paniculata* chromosomes to the *rustica* homologues appears to be the most likely explanation.
The F_1 hybrid sterility may also be explained as due to such non-homologous crossing-over.

1072. WÓYCICKI, Z. 633.71:575.127.2:576.356
Quelques remarques sur la méiose chez l'hybride stérile de *Nicotiana atropurpurea* x *Nic. silvestris*. (**Some remarks on meiosis in the sterile hybrid of *N. atropurpurea* x *N. silvestris*.**)
Acta Soc. Bot. Polon. 1933: 10: 441–49.
A note devoted mainly to a criticism of Sachova's interpretation of the metaphase plate in the species cross in question. The writer found in this cross 12 bivalents and 12 *N. atropurpurea* univalents, and secondary association was noted. The nature of the latter phenomenon is considered in citations from other workers.

1073. KOSTOFF, D. and AXAMITNAJA, I. 633.71:575.129:581.192
(Studies on polyploid plants. VII. Chemical analysis of F_1 hybrids and their amphidiploids.)
C.R. Acad. Sci. URSS 1935 : **1** : 325–29.

The F_1 hybrids and amphidiploids investigated were those of the cross *N. rustica* L. var. *humilis* syn. *pumila* x *N. paniculata* L. form *cordifolia* (*N. rupa*) and *N. glauca* x *N. Langsdorffii* (*N. Waviloviana*). An analysis of the leaves of the whole plant at the beginning of and during the flowering period shewed that the greater amount of water and ash and less cellulose and hemicellulose found in the amphidiploids is to be accounted for by the larger cell size of these plants. There was a greater percentage of nitrogen and protein and a smaller percentage of starch and carbohydrates in the F_1 hybrids compared with the amphidiploids. On the whole, the differences between the amounts of the various substances investigated were of the same order in the F_1 hybrids and their amphidiploids though the degree of difference varied considerably.
These biochemical differences may prove of importance in the problem of evolution.

1074. 633.71:576.356.5
TERNOVSKY, M. F. 633.71:576.356.52
Erscheinungen der Polyploidie bei Artenbastarden von *Nicotiana*. **(Phenomena of polyploidy in species hybrids of *Nicotiana*.)**
Z. Zücht. 1935 : A **20** : 268–89.

The occurrence of polyploidy was studied in a number of species hybrids.
N. rustica x N. *tabacum* both with n = 24 chromosomes gave completely sterile amphihaploid (i.e. one genom from each parent) hybrids. One of these plants back-crossed to *N. tabacum* shewed itself to be fertile with 72 somatic chromosomes and a preponderance of *tabacum* characters, in the author's terminology, therefore a sesquidiploid with one genom from *N. rustica* and two from *N. tabacum*.
The two genoms of *tabacum* conjugated at meiosis, which was fairly regular, leaving the *rustica* chromosomes as univalents. The plant was only fertile on back-crossing to *N. tabacum* and is assumed to have arisen by the fertilization of an egg cell of *N. rustica* by a diploid pollen grain of *N. tabacum*. *N. tabacum* (n = 24) x *N. glauca* (n = 12) gave normally only sterile F_1 progeny. Four sesquidiploid plants were found by the author with two genoms of *tabacum* and one of *glauca* but only when *N. tabacum* was used as the female parent.
Meiosis was less irregular than in the amphihaploids. The sesquidiploids were only fertile when back-crossed to the parent forms; and they have clearly arisen by the fertilization of a diploid *tabacum* egg cell with the normal pollen of *N. glauca*.
The cross *N. glutinosa* (n = 12) x *N. tabacum* (n = 24) gives usually only sterile progeny. Amphidiploids have however been observed and described under the name of *N. digluta*, others were found by the author mostly in crosses made in the autumn and their occurrence is attributed to a drop in the temperature. One plant was observed with two shoots, one fertile the other completely sterile and a cytological investigation shewed the former to be a vegetative mutation with the doubled chromosome number and a regular reduction division.
Two amphidiploid plants were found in the F_1 of the cross *N. tabacum* x *N. glauca* and only differed from the rest of the F_1 in their fertility. Meiosis was only relatively regular, the F_2 and F_3 progeny were very uniform. This amphidiploid form is named *N. ditagla* and has been successfully crossed with *tabacum*, *glauca*, *silvestris*, *rustica*, *Sanderae* and *paniculata*.
Several amphidiploid plants were found in the F_2 of the cross *N. tabacum* x *N. glauca* among the progeny of a weakly fertile amphihaploid plant, as a result of a doubling of the chromosome number in the gametes. The hybrids of *N. rustica* x *N. tabacum* are normally completely sterile, but by repeated back-crossing to *N. tabacum* and open-pollination, a sesquidiploid plant was produced analogous with that previously described.
Another sesquidiploid from the back-cross (*N. tabacum* x *N. silvestris*) x *N. tabacum* is described. The plant was completely self-fertile and segregated in the following generation into forms of preponderately *tabacum* type.
Three haploid plants were found, two haploid of *N. tabacum* from the crosses *N. tabacum* x *N. longiflora* and *N. tabacum* x *N. glauca*, the other was a haploid of *N rustica* from the cross *N. rustica* x *N. glauca*.
The possible causes for the occurrence of polyploidy are discussed.

1075. DUFRENOY, J. 633.71:576.356.5:576.31
Comparative metabolism of the cells of various chromosomal types of *Nicotiana tabacum*.
Univ. Calif. Publ. Bot. 1935 : **18** : 1–22.
Changes in genetic constitution are accompanied by changes in metabolic activity, which in this preliminary investigation were studied microscopically. Differences between normal plants and haploid or monosomic plants were found in the size of the vacuole and the stability of its material, the chemical constitution of the anthocyanols, the size and shape of the mitochondria and plastids, and the ability to translocate and utilize starch.
The distribution of anthocyanol in three pink-flowering types is described.

1076. SCHMIDT, M. 633.71–2.3–1.521.6:575(43)
Immunitätszüchtung bei Tabak. (**Immunity breeding with tobacco.**)
Naturwissenschaften 1934 : **22** : 557–59.
A united effort is being made by various research institutes in Germany to evolve a form of tobacco resistant to *Pseudomonas tabaci*. Out of 102 varieties and samples of *Nicotiana tabacum* none proved resistant and 9 varieties of *N. rustica* gave a similar result. One form *N. viscosa* (probably *N. Langsdorffii* var. *longiflora*), *N. affinis* (*N. alata* var. *grandiflora*), *N. plumgabinifolia* and some other species were resistant, while *N. Sanderae* segregated into susceptible and only slightly susceptible plants.
Breeding tests with these and other forms are proceeding and in spite of the difficulties inherent in working with species crosses it is hoped that some good types may be obtained with the desired *tabacum* characters. Selection among other types for only slightly susceptible forms from which on crossing transgressive resistant segregates may be obtained is regarded as another possible method of achieving the desired type.

1077. VALLEAU, W. D. 633.71–2.8–1.521.6
The resistance of Ambalema tobacco to different viruses.
Phytopathology 1935 : **25** : p. 37. (Abst.)
The reaction of *Nicotiana tabacum* var. Ambalema to a number of different virus diseases is given.

1078. WELLENSIEK, S. J. 633.72:575.42
Onderzoekingen over quantitatieve thee-selectie I. (**Researches on quantitative tea-selection I.**)
Arch. Theecult. Ned.-Ind. 1934 : **8** : 9–37.
This paper is the first of a series dealing with experiments in several gardens.
A " reform " seed garden was planted at Tjinjiroean in 1929–30 with seeds from selected mother bushes raised from second generation Bazaloni seed.
Nursery selection involved the weighing of the tops of 19,817 plants after stumping at 15 cms. The frequency distribution for weight is completely one-sided, and ranges from 10,768 plants at 0–100 grams to 1 at 900–1000 and 1 at 1300–1400 grams. Further details are given in tables.
To avoid soil differences the nursery was divided into groups of 60 plants and the 20 per cent heaviest selected from each group. As a basis for comparison some " average plants " were included. In addition the 1·83 per cent heaviest plants were separately selected. The plants were planted out at 5 x 6 feet in a test plucking garden isolated from other tea in a cinchona estate 1500 metres above sea level.
Development was good and the plants of uniform type.
After pruning in April, individual yield records were kept for 8 rounds of fortnightly test pickings starting in October 1932 on 3789 plants.
The space available determined the degree of selection. About 11 per cent of the best plants for yield and type were pruned and replanted at 6 x 6 metres, other plants being removed.
The garden was divided into 8 blocks and yield figures are given for all. The excess of the mean yield of the selected plants over the general mean was 114·1 per cent, and the biggest differences occurred on the poorest plots.

The very best plants from each block, 24 in all, were chosen for vegetative propagation. Their mean was 228·9 per cent greater that the average.
Although nursery selection does not guarantee higher yields, it gives a much greater chance of obtaining them ; for example, the 20 per cent heaviest plants gave yields 31·4 per cent greater than the " average " plants, and the effect of selecting the 1·83 per cent heaviest was almost twice as great. This effect of nursery selection also is greatest in the blocks with the lowest mean yields.
The influence of position in the garden border and shading effects is considered.
The test yields when converted give the high figure of 1722 half kilograms of dry leaf per hectare per year, and similar calculations further illustrate the value of selection by nursery weights and test pluckings.
The " efficiency " of the plantation is discussed and illustrated with effective graphs. " Ideal efficiency " would be reached with all plants giving equal yields. In this garden selective thinning out of 10, 25, 50 and 75 per cent of the poorer plants would give a reduction in yield of about 2, 8, 25 and 50 per cent respectively. Thinning should be carried out so that the reduction in yield is balanced by increased growth due to extra spacing.
The results are held to be of general value L.E.M.

1079. FREIRE, C. V. 633.73(81)
Contribuição ao estudo histológico dos cafeeiros no Brasil. (**Contribution to the histological study of the coffee trees of Brazil**).
Rev. Dep. Nac. Café, Rio de J. 1935 : **2** : 399–400, 591–92.
A description of the second plant of the series (see " Plant Breeding Abstracts," Vol. V, Abst. 765) which resembles *Coffea macrochlamys* K. Schum. in some characters and *C. canephora* Pierre (*C. robusta*) in others.

1080. MONTEIRO, F. 633.73:57.087.1:575.1
Aplicaçao da biométrica á genética e systemática experimental do cafeeiro. (**Application of biometry to the genetics and experimental systematics of coffee.**)
Rev. Dep. Nac. Café, Rio de J. 1935 : **2** : 17–24.
A brief explanation of the principles of biometry for the genetical worker.

1081. ROCHETTE, M. 633.73:575.42(66.68)
Culture et Sélection du caféier en Côte d'Ivoire. (**Cultivation and selection of coffee on the Ivory Coast.**)
Rev. Bot Appl. 1935 : **15** : 32–39.
Notes on the varieties cultivated, on their identity and on the preliminary stages in selection that are to lead to breeding work later on.

1082. KRUG, C. A. and MENDES, J. E. T. 633.73:581.481:575
A chamada " Polyembryonia " em *Coffea*. (**So-called " polyembryony " in *Coffea*.**)
Rev. Agric., S. Paulo 1935 : **10** : 43–48.
The authors point out the fallacy of the method of Hille Ris Lambers of studying the hereditary nature of the double seeds occurring in coffee by examining the progeny of these seeds alone, since the hereditary nature of the phenomena could be studied equally well by examining the progeny also of the normal seeds from the plants exhibiting it.
The phenomenon is analysed and shewn to be merely the development of more than one seed in the same locule of the ovary and microphotographs are given in proof of the independence of the two ovules and of the seeds formed from them. True polyembryony has also been observed in coffee, though with extreme rarity.
Tables are given shewing the number of cases of false polyembryony observed in fifty-four trees of *Coffea arabica* L. and three of *C. robusta*, which illustrate the variability of the character from tree to tree. The percentages of locules with more than one seed varied from 0 to 27·5 per cent and there is thus every indication that the phenomenon is inherited. The question will be the subject of further observation.

1083. VASILEVSKAJA, N. A. 633.75(016)
(A bibliography on the opium poppy.)
Bull. Appl. Bot. Leningrad 1934 : Ser. 13(2) : Pp. 85.
A very full bibliography with abstracts, including a brief section on breeding.

AROMATIC PLANTS, SPICES ETC. 633.81/4

1084. WULFF, E. V. and NILOV, V. I. 633.81
(Essential oil plants, their cultivation and essential oils. Vol. II. Special Part.)
Lenin. Acad. Agric. Sci., Inst. Pl. Ind. Leningrad 1934 : Pp. 389.
A volume devoted to the aromatic plants arranged according to families, starting with the lichens and ending with the *Myrtaceae*. A further volume will complete the families, from the *Geraniaceae* to the *Compositae*. The species used, the method of utilization, a description of the plant, its area of distribution and the characters of the oil obtained are given for each plant in turn, with lists of appropriate references.

1085. KAISER, S. 633.842:575.061.1:581.18
Inheritance of a geotropic response in *Capsicum* fruits.
Bull Torrey Bot. Cl. 1935 : **62** : 75–80.
Reciprocal crosses were made between pendent and erect fruited inbred plants of red pepper *Capsicum annum* and the F_1 all resembled the pendent parents in the habit of the mature fruits, no intermediate types being observed. In F_2 the ratio between pendent and erect types approximated to 3 : 1. Since, however, about 1·7 per cent of the plants were intermediate and in 11·7 per cent both pendent and erect fruits occurred on the same plant, it is assumed that the genetic mechanism controlling fruit position is subject to occasional modification, presumably by physiological factors.
Certain exceptional segregations from crosses in which the ♀ parent was pendent could, it is pointed out, be explained by a hypothesis of factors modifying the expression of dominance.
In general, a single gene difference will, it is believed, explain the two fruit positions studied. Experiments indicated that this fruiting habit is an expression of the genetically determined growth response of the stem to gravity.

OIL PLANTS 633.85

1086. HILTEBRANDT, V. M. 633.85:575(47)
(Prospects and problems in breeding oilseeds in the U.S.S.R.)
Lenin Acad. Agric. Sci., Res. Inst. Oil Cult. Krasnodar 1932 : Sci. Industr. Mem. Nos. 2–3 : 11–16.
A much greater range of oil plants is now being used in the U.S.S.R. than at any previous time. Since most of them are cross-fertilized plants, the first step is enforced self-pollination to unmask possibly desirable recessive characters. Most of them have been so little worked on previously that selection provides sufficient improvement for the present. The main problems are to obtain forms of these various plants suitable for growing in new regions, in the north and east, and in arid zones. Some of the oil plants are particularly favourable for growing in arid regions, e.g. safflower, certain varieties of sunflower and of cruciferous oilseeds. Winter sowing is becoming much more common, leading to the necessity for cold resistant forms.
The next great problem is the production of disease resistant forms. Apart from the sunflowers resistant to *Orobanche*, little has yet been done in this direction. The problem will have to be solved independently for each separate plant and for each region but hybridization, often distant, even interspecific hybridization, will usually be necessary. Recourse must usually be had to artificial infection. In the important task of selecting for increased oil content it is essential to have more sensitive methods of determining this. Though hardly anything is known on the question, there are clear indications that the hereditary variations in oil content are considerable and that there is here a wide field of possibilities for the breeder. Still less has been done on the heredity of the quality of the oil, though this is a cardinal point when it comes to the disposal of the product.
The last essential in breeding Soviet oilseeds is to produce types suitable for mechanical harvesting.

1087. 633.85–1.525
KUPTSOV, A. I. 633.85:575(47)
(Prospects and problems of naturalizing oilseeds in new regions of the U.S.S.R.)
Lenin Acad. Agric. Sci., Res. Inst. Oil Cult. Krasnodar 1932 : Sci. Industr. Mem. Nos. 2–3 : 17–28.

The history of oilseed cultivation in Russia is briefly traced. At present the main desire in extending their cultivation is to occupy new areas in cool, moist zones and in the arid zones, most of which also have severe winters. The photo period is one of the main factors to be considered in the choice of plants for cultivation in any new region. For instance, the forms suited to arid zones are of two types, firstly the long-day types with short vegetative period which mature before the summer drought commences, and the short-day forms which in the early part of the year form a copious root system, their development being arrested during the summer, but which are able to carry through on the scanty summer rainfall and mature in autumn. The group of drought-resistant spring-sown oilseeds contains certain very promising species, e.g. *Brassica juncea, Eruca sativa* and linseed, and by breeding still earlier maturing forms their cultivation will be greatly extended in the arid zones. Another promising line for increasing drought resistance is to breed forms suitable for autumn sowing, which in safflower is being achieved by using *Carthamus lunatus*, a wild species comprising both spring and autumn forms, for crossing with *C. tinctorius*.

1088. ŠARAPOV, N. I. 633.85:633.367
(Lupin as an oil crop.)
Semenovodstvo (Seed Growing) 1934 : No. 5 : p. 88.

Hitherto the oil content of the different varieties and species of lupin has been regarded as varying from 4 per cent to 6 per cent. The Institute of Plant Industry has however carried out an extensive analysis of a wide range of forms, involving 1,400 specimens. Some of the outstanding results are tabulated, and shew that the best forms of lupin contain up to 17–20 per cent of oil, which is equal to the average soya bean.

The forms from high or northern situations display the maximum oil content, of which the highest were observed in *Lupinus mutabilis* and the lowest in *L. angustifolius*.

1089. 633.853.74:575.42
FLORES, S. S. 633.853.74–1.557:551.56
Sesamum culture as affected by seed selection.
Philipp. Agric. 1935 : **23** : 725–27. (Abst.)

A description of an experiment in which selection for high yield was successful and certain relations between climatic conditions and productivity were noted.

1090. BOERGER, A. 633.854.54:575.42(89)
Selección biológica del lino (*Linum usitatissimum* L.) en La Estanzuela.
[Biological selection in linseed (*L. usitatissimum* L.) in La Estanzuela.]
Rev. Sud.-Amer. Bot. Montevideo 1934 : **1**(4) : Pp. 7.

The region of the Rio de la Plata is one of the most important linseed producing districts and breeding work has been in progress for some time with the object of raising the yield, quality and disease resistance and of producing a type suitable as a source of both fibre and oil. The method of individual plant selection was used and three markedly superior pedigree lines 8b, 8c and 9d were selected. Line 12c12 combines a high yield of seed with high oil content (38·07 per cent of the ether extract as compared with 32·93 per cent for the local strains).

A new variety " Ar " has been obtained from a cross between 8c x 7e ; the new variety gives a high yield of seed and has the advantage of being tolerant of late sowing.

By repeated selection of the best survivors in flax-sick soil, lines have been selected which can be cultivated continuously for up to four years in the same soil without succumbing to the disease.

By selection a line intermediate in type of growth between the fibre and oil varieties has been obtained, which gives a yield of seed up to 72 per cent of that of the pure oil type, whereas the pure fibre type gives only 45 per cent. Further selection on these lines is being practised and the hope is entertained that a good dual-purpose form will ultimately be produced.

1091. 633.854.745:575
633.854.559:575

(Sutza, burning-thorny-wort, Makhorka.)

Lenin Acad. Agric. Sci., Inst. Oil Cult. Krasnodar 1934 : No. 7 : Pp. 99.

Perilla ocymoides L. is used both as an ornamental plant and for extracting oil from the seeds, the oil yielded being superior even to linseed oil in quality as a drying oil. Indications are given of the characteristics of the plant, and the regions and the methods of its cultivation. There follows a special article of four pages, by D. P. Umen, on " The aims and problems of breeding work with *Perilla*." The defects of the plant are indicated, chief among these being a relatively low yield— 5–12 centners of seed per ha., long vegetative period— 5–6 months, tendency to wilt diseases and to shedding of seeds, and insufficient compactness of growth for purposes of harvesting. Breeding work aiming at improvement in these characters was begun in 1931.

The plants are cross-fertilized and breeding was begun on the lines of repeated individual plant selection. The work has already shewn great possibilities in breeding for increased earliness : one line from the Far East ripened in 1931 at the end of July, and in 1933 was harvested on the 15th August, whereas the ordinary forms ripened only at the end of September or beginning of October. This line has been issued as No. 30 and gives yields of up to 10 centners seed per ha. Various other early lines have also been selected.

So far no forms resistant to wilt diseases and to shedding have been obtained.

Euphorbia lathyris L. (*non* Georgi) whose seeds contain a valuable oil with an iodine number of 81·7, is described on similar lines, with a chapter on breeding by N. F. Sergeeva entitled " Preliminary conclusions from breeding work with *Euphorbia lathyris* L." Among the defects of this plant from the point of view of cultivation the chief are the unusual length of time from sowing to germination (25th March to 20th May) and the uneven germination ; it is on the other hand tolerant of excess moisture and of frost to −2·4°C., the pods do not shed, the capsules develop only at the apex of the plant, thus facilitating mechanical harvesting, and the oil content of the seeds is very high, reaching 71·6 per cent of the dry weight of the seed in the best lines. These qualities, coupled with the high yield of seeds, lead the author to regard the plant as a most favourable object for breeding, rapid and uniform germination and resistance to *Fusarium* being the main lines on which improvement is desired, combined with high yield and oil content, earliness and low seed coat. Winter sowing proved an efficient means of securing uniformity of germination and so of maturity, the germination being also 10 or more days earlier.

Data are given for a number of lines examined with these points in view, as a result of which 350 of the best plants were selected. Some of these are characterized by greatly increased uniformity of germination and of ripening and others by very low attack by *Fusarium*. Attempts are also being made to select lines with reduced shedding and if possible to eliminate the caustic action of the tissues on the skin.

The bulletin ends with an article on the use of *Nicotiana rustica* as an oil plant.

1092. Vinogradov, F. 633.854.78–2.5–1.521.6

(Sunflower resistant to *Orobanche*.)

Semenovodstvo (Seed Growing) 1935 : No. 2 : p. 46.

Five new varities resistant to *Orobanche* gave a degree of attack varying from 0 to 6·9 per cent when tested with the virulent race B of the parasite, giving yields of the order of 12–14 centners per ha. on ground where susceptible varieties gave no more than 0·20–0·23. They are very little inferior or equal to the standard susceptible varieties in oil content.

1093. Hinrichs, C. T. 633.855.34 :575

Die Saatölpalme. **(The oil palm for seed.)**

Tropenpflanzer 1934 : 37 : 64–71.

The importance of the utmost care in seed selection is evident if high yields are to be ensured. A full outline is given of methods of the systematic inspection of trees, yield recording and the selection of the most promising individuals as breeding material ; and a method of controlled pollination, pollen storage and the grading of potential mother trees is described in detail.

Since little has been done in the breeding of oil palms, attention should be directed to the production of " pure lines " which would yield genetically uniform progeny.

The possibilities of improvement by hybridization accompanied by similar methods of record keeping and control are also mentioned.

1094. STOFFELS, E. 633.855.34:581.162.3
Influence de la fécondation artificielle des fleurs d'*Elaeis guineensis* sur la production des fruits. (**The effect of artificial pollination of the flowers of *E. guineensis* on fruit production.**)
Bull. Agric. Congo Belge 1934 : **25** : 347–57.

A method of hand-pollination is described and the results compared with those of natural pollination. The increased yield obtained by hand-pollination was not sufficient to make the method an economic proposition. The data obtained from artificial pollination by means of the Schaffner pump, though insufficient for definite conclusions, suggest that the method did not increase the yield.

MEDICINAL PLANTS 633.88

1095. MENZEL, R. 633.885.1:575
Über die Herkunft des Chinins. (**On the origin of quinine.**)
Schweiz. Landw. Mh. 1934 : No. 10 : 257–64.

In tracing the development of *Cinchona* cultivation from its first discovery in South America, the author points an emphatic moral. The Dutch in Java used chemical analyses of the quinine content as a basis for systematic selection, whereas owing to the failure to do this the large plantations in India and Ceylon had to be uprooted, having got into a state of complete varietal chaos.

A brief description of the methods of extraction is given.

RUBBER PLANTS 633.9

1096. BOSSÉ, G. G. and PRILUZKAIA, V. I. 633.913(47)
(**The problem of discovering rubber plants in the U.S.S.R.**)
Sovetskaja Botanika (Soviet Botany) 1934 : No. 5 : 94–125.

A full account of the Soviet campaign for the discovery of rubber plants capable of cultivation in the temperate conditions of the Soviet territory. Analyses have been made of 1048 species covering 316 genera and 95 families and rubber was found in 609 of these species. Some of these are new species. The most promising family is the Compositae, *Taraxacum kok-saghyz* Rodin., *T. megalorrhizon* (Forsk.) Hand. Mazz. *T. gymnanthum* DC., *Euonymus* L., *Scorzonera acanthoclada* Franch. and *Cycanchum acutum* L. being the most promising species.

1097. PODDUBNAJA-ARNOLDI, W., STESTCHINA, N. and SOSNOVETZ, A. 633.913:581.162.5:576.356 633.913:583
Der Charakter und die Ursachen der Sterilität bei *Scorzonera tau-saghys*. Lipsch. et Bosse. (**The nature and causes of sterility in *S. tau-saghys*. Lipsch. et Bosse.**)
Beih. bot. Zbl. 1935 : **53** : 309–39.

In plant material consisting of various geographical forms of *Scorzonera tau-saghys* an extensive study was made of meiosis during pollen development and anomalies in the heterotypic and homeotypic divisions were found though sometimes elsewhere on the same plant meiosis was regular. The aberrations consisted in lagging chromosomes, the formation of adventitious nuclei, the presence of chromosome fragments, the elimination of chromosomes from the spindle, etc. Moreover pollen nuclei with aberrant chromosome numbers of widely divergent size were formed, as well as poly-nuclear pollen cells in some cases.

The morphological characteristics of normal and abnormal pollen and its functional capacity are discussed. Where spermatogenesis occurred it was quite regular, and well developed generative nuclei were produced. Apparently gametes with aberrant chromosome numbers were viable and in one collection of plants 50 per cent of the pollen was viable.

The possible causes of the disturbances in meiosis and the problem of the partial gametophytic sterility of *Scorzonera tau-saghys* are considered at some length ; and they are ultimately shewn to be due, not to hybridization, but to the meiotic irregularities resulting from a prevailing low temperature combined with high humidity. In addition, however, *Scorzonera tau-saghys* was demonstrated to be self-sterile.

Macrospore formation and development were also examined in detail and revealed similar irregularities to those found in the pollen. Here too sterility is attributed to unfavourable external conditions and possibly defective nutrition in the case of degeneration phenomena. The haploid number in the embryo sac was 7.
Fertilization occurs on the day after pollination, only one embryo being formed and never any adventitious embryos.
As a rule the somatic chromosome number in the different geographical and morphological variants was 14 and the same number was found in other species of *Scorzonera*. In the closely related genus *Tragopogon*, however, the somatic chromosome numbers were 12 and 14. Also root material of *Scorzonera tau-saghys* itself was found with 15, 16, 18, 19, 20 and 21 chromosomes.
Though no individuals with a chromosome number lower than 14 or higher than 21 were observed the existence of other polyploid forms is thought probable.
The authors believe that the occurrence of individuals with aberrant chromosome numbers might lead to the production of new forms.

1098. Novikov, G. N. and Stepanov, S. I. 633.913–1.411.9
(Note on the rubber content of certain species of *Scorzonera* and *Cynanchum acutum* L.)
Sovetskaja Botanika (Soviet Botany) 1934 : No. 5 : 163–64.

The rubber and resin contents of various species of *Scorzonera* and of *Cynanchum acutum* are given. The latter species is particularly promising, containing up to 5–7 per cent rubber when growing on salt-marshes.

1099. 633.913–1.524.2:678.1
Polhamus, L. G., Hill, H. H. and Elder, J. A. 633.913:575.12:678.1
The rubber content of two species of *Cryptostegia* and of an interspecific hybrid in Florida.
Tech. Bull. U.S. Dep. Agric. 1934 : No. 457 : Pp. 23.

Cryptostegia grandiflora R. Brown and *C. madagascariensis* Bojer, formerly used as sources of rubber by the natives of India and Madagascar, have been introduced as ornamentals into tropical America. Botanical descriptions of the two species and of a natural hybrid between them are given ; the hybrid partakes of the characters of each parent and is intermediate in some respects. The rubber content was estimated by extracting the dried leaves with benzol, after a preliminary extraction with acetone. The highest contents in leaf samples were 3·13 per cent, 2·94 per cent and 5·97 per cent and in the leaves of individual plants 3·34 per cent, 3·14 per cent, and 8·60 per cent in *C. grandiflora*, *C. madagascariensis* and the hybrid respectively. Variation occurring in individual plants could to some extent be ascribed to location. A marked seasonal variation was found, from a minimum just after the defoliation period in March to a maximum about November or December. The leaves take about 3½ months to reach their maximum rubber content.
The resins, of unknown composition, and bast fibres contained in the plants may also be of economic importance. A correlation was found in the two species—but not in the hybrid—between " resin " content (from the acetone extraction) and rubber content.
The hybrid does not breed true from seed, and artificial cross-pollination of the two species has so far failed. The best method of vegetative propagation is marcottage or air-layering and by raising clones in this way it is hoped to estimate the relative effects of heredity and environment on rubber content.

FRUIT TREES 634

1100. Stepanov, P. A. 634:575(063)(47)
(Summary of the first conference of fruticulturists.)
Scientific Fruit Growing. Bull. Lenin Acad. Agric. Sci., Res. Inst. Fruit Grow. I.V. Michurin, 1934 : No. 5–6 : 48–51.

An account of the conference and the papers read, including reference to a number of new cold-resistant apple seedlings raised by Smirnov and capable of growing as far north as Archangel, gooseberry seedlings raised by the same worker resistant to *Sphaerotheca*, and large-fruited raspberries for the north ; also to hardy raspberry hybrids with high yielding capacity introduced by Rudobel'skii, and to the study of the hardy Siberian currants, of which 300 different forms are under observation, some of them with fruits weighing up to 4g., by Ivanitskii.

1101. ODINTSOV, V. A. 634:575.127

(Michurin and his work.)

Scientific Fruit Growing. Bull. Lenin Acad. Agric. Sci., Res. Inst. Fruit Grow. I. V. Michurin 1934 : No. 3 : 5–11.

The activities of I. V. Michurin in producing new fruit trees are briefly traced. Having convinced himself of the inadeqacy of acclimatization an early start was made in producing improved sorts by sowing the seeds and selecting among their seedlings, the success of which led Michurin to his final method of hybridization. After entire lack of recognition by the Czarist Government and considerable opposition from scientific circles even after the revolution, Michurin finally gained recognition for his principles, which was marked by the establishment in 1931 of a special research station in his name. His main principles are (1) the greater adaptability to new regions, or to rigorous conditions, of hybrids from geographically widely separated forms ; the best of his new varieties have been produced in this way ; (2) hybridization between distant species and genera, which is often effected only by the application of special measures such as vegetative rapprochement, mixture of pollen, etc.; forms of very high quality have been produced in this way ; (3) the choice of trees of the most vigorous and healthy type for use as parents, such trees being said to give a better progeny than trees of lower condition ; (4) postponement of selection till the full maturity of the hybrids, which often improve very materially in their second and later crops ; thus selection on the results of the first crop is to be avoided ; (5) in crosses between tender southern forms and the local forms the hybrids are not allowed to grow in too rich soil, so as to prevent the dominance of the characters of the southern forms ; they must however receive a due amount of attention and not be exposed to intense cold.

Though all his principles were in the beginning denied by scientists, some of them, the value of distant hybridization in particular, have now been substantiated by scientists the world over and it is thought that his emphasis on the importance of external influences may in time be similarly substantiated.

The real test remains the wide application that his seedlings have received : in 1934 about seventy thousand two-year old seedlings of his varieties were planted in the R.S.F.S.R. alone and in 1935 one fifth of the whole of the seedlings planted will be of his varieties. His varieties have not only opened up the possibilities of fruit cultivation in vast areas hitherto thought unsuitable for the purpose but have in so doing freed much of the more southern territory for the cultivation of tender and sub-tropical crops.

The first problem undertaken by the new station has been a full study of all the varieties already produced by Michurin, to form the basis of the correct distribution of them to the different regions of cultivation. Observations have been made on the varieties growing in a large number of different districts and indicate, among other things, in which districts the different varieties are frost-resistant. All varieties have proved more frost-resistant when reproduced on the spot rather than when planting material has been sent out from Michurinsk. Laboratory studies on cold resistance have supplemented these observations and have shewn several of the new varieties to be hardier than the hardiest known standard varieties. The apple Borsdorf Chinese is outstanding in this respect.

The choice of suitable pollinators for the different varieties is the next important problem and the studies made have shewn the best combinations for all the main varieties. Pollen germination tests have shewn the pollen of Michurin's new varieties to be on the whole higher in germination than that of the old varieties.

The work of distant hybridization is being continued and numbers of young seedlings are now under observation. Experiments on the same lines are being carried out also at a number of other stations and material has been sent from Michurinsk, including pollen by air mail, for them to employ in their work.

Chemical analyses and technological tests have been made on the varieties to indicate which are most suitable for dessert, wine, preserving and other uses. Agronomical experiments have shewn that many of the Michurin varieties require different cultural measures from the old varieties and special attention is being devoted to this aspect.

1102. Silant'ev, I. G. 634:575.127
(Michurin's methods—the principles of fruit breeding.)
Semenovodstvo (Seed Growing) 1934 : No. 6 : 65–67.

A brief review is given of Michurin's methods. In the choice of parental forms he adopted the principle that the adaptation to the required conditions is greatest in the hybrids from those parents most removed one from the other in respect of place of origin and ecological type. The wild species have figured especially largely in all Michurin's work. For instance the pear Michurin's Winter Beurré was produced by crossing the wild pear *Pyrus ussuriensis* with a well-known Italian variety Beurré Royal. The former species is the most frost-resistant pear known and the hybrid combines the size and quality of the Beurré parent and the frost resistance of the wild species. The same principle has been applied to the other fruits.

The principle of distant hybridization has been very widely applied by Michurin. In this connexion he has shewn that by vegetative approach the incompatibility between species can be considerably diminished. Thus by grafting a pear scion on to a mountain ash and pollinating the one with the other when the pear scion begins to flower, successful crosses have been made between *Sorbus* and *Pyrus*, crosses which otherwise are very difficult to make.

Again by the method of intermediate crossing he has been able to combine incompatible parents, e.g. to combine *Amygdalus nana* L. with the cultivated peach, *A. nana* was crossed with *A. Davidiana* Franch., which crosses with both species. This cross gave the so-called Posrednik (intermediate) almond, which was both frost-resistant like *A. nana* and would cross with the cultivated peach. Though in this particular case the seedlings were all either matroclinous or patroclinous, the method is recommended for use in other similar cases.

The method of pollination with a mixture of pollen from a number of different species and even genera has also been used ; apples have been pollinated with a mixture of pollen from cherries, plums, pears, medlar, mountain ash, currants and gooseberries, from which good hybrid seeds with perfect germinating capacity have been obtained.

Michurin also attaches great importance to the nurture of the hybrids, whereby the properties of one or other of the parental species can be accentuated or diminished.

1103. Tatarinzev, A. S. 634:575.127:581.162.5
(The search for methods of overcoming difficulties in crossing.)
Scientific Fruit Growing. Bull. Lenin Acad. Agric. Sci., Res. Inst. Fruit Grow. I. V. Michurin 1934 : No. 3 : 31–38.

I. V. Michurin has used a variety of methods for overcoming the incompatibility of distant species on crossing, including the use of young hybrid seedlings in their first flowering season, previous vegetative rapprochement of the parental forms, the production of an intermediate hybrid to bridge the gap between the parental species, the removal from the maternal parent of all the flowers but those pollinated artificially, the admixture of pollen of the maternal species to that of the species used for pollinating, the use of a mixture of pollen from a number of different species and genera, the application to the maternal stigma of a piece of the style of the pollen parent, and the action of various physical agents on the pollen. The study of the causes of hybrid incompatibility is providing the physiological basis for many of these methods. For example, sterility frequently arises from the failure of the pollen tube in foreign plasma to reach the embryo sac and can sometimes be avoided by cutting off part of the style or by grafting the stigma of the pollen parent on to the cut end of the maternal style. Yasuda has further reported a reduction in incompatibility resulting from the grafting of the stigma of a third species on to the maternal style. This demonstrates the influence of grafting on the compatibility of species, which is the foundation of Michurin's method of vegetative rapprochement. Again the use of plants at the beginning or end of their growing season is known to be a means of overcoming incompatibility.

Viable seedlings from incompatible crosses have been obtained by artificial culture of the embryo in a number of cases, including cherry crosses by Tukey, whose results are described in detail, as having especial significance for the problem of distant hybridization.

Sterility may be prevented at times by an alteration in the chromosome number, as in Karpechenko's experiments with the tetraploid cabbage, which may offer a promising method of creating links between two incompatible species of the kind envisaged and obtained by Michurin.
In view of the variety of causes which may be responsible for incompatibility between species and genera, particular attention is being given to the discovery of these in the work on distant hybridization in the fruit trees. In spite of their morphological similarity the genera *Pyrus* and *Malus* have not yet been crossed but by crossing with these genera Michurin has already made great progress in producing a large-fruited *Sorbus*, to which great expectations are attached, for *Sorbus aucuparia* is so exceptionally hardy that it grows as far north as any tree known: an edible form therefore, will supply whole areas with a new fruit. Crosses of the apple and pear with *Crataegus* are also promising on account of the later flowering of this genus, in consequence of which it escapes the spring frosts.
A plant has been obtained which is thought to be a hybrid between the raspberry and the strawberry. It is sterile and resembles the raspberry in structure. Various other combinations of genera are mentioned as being of undoubted interest and possible promise and many of them are being tried, some of the pollinated flowers being fixed and examined microscopically in the attempt to discover the cause of their incompatibility. At the same time observations are being made on the effect of the various means earlier referred to for overcoming incompatibility. A mixture of pollen of a number of varieties is often used so as to increase the chances of success, in view of the marked differences in success obtained with different varieties of the same species by other investigators on interspecific and intergeneric crossing. A further advantage is that the number of combinations is in this way very much increased without unduly enlarging the scale of work. Mixtures of pollen have also at times been found to have the effect of mutual stimulation, thus further enhancing the probabilities of success.

1104. JENIKEEV, H. 634:575.127:632.111
(Investigation of the cold resistance of Michurin's varieties in the Voronesh, Kursk and Moscow regions and the Central Volga Basin.)
Scientific Fruit Growing. Bull. Lenin Acad. Agric. Sci., Res. Inst. Fruit Grow. I. V. Michurin 1934: No. 3: 11–20.
ISSAYEV, S. I.
(Observations on the Michurin varieties near Moscow.)
Scientific Fruit Growing. Bull. Lenin Acad. Agric. Sci., Res. Inst. Fruit Grow. I. V. Michurin 1934: No. 3: 20–25.

Examinations were made on a large number of the new varieties of fruit trees produced by I. V. Michurin and shewed that in the four main regions of the central belt of the Soviet Union these new varieties are not only capable of withstanding the normal frosts occurring there but even remained undamaged in the exceptionally severe winter of 1928/29. The results of the observations are presented and the most resistant varieties of apples, pears and cherries are indicated in the first article. The second article describes similar examinations on the largest existing collection of the Michurin varieties, at the Timirjazev Experiment Station, where fifty of his new fruits are grown and have been under observation since 1929. In this case besides frost resistance various other characters such as cropping, disease resistance, etc. were examined in the best varieties of apples, pears and cherries, together with certain promising raspberry, gooseberry, quince, vine and melon hybrids.

1105. 634:581.162.3
ALVAREZ-LAVIADA, M. M. 634:575.182
La pollinazione incrociata. **(Cross-pollination.)**
L'ortofruttic. Ital. 1935: 4: 1–2.

The principles of cross-pollination are outlined. The problem of xenia is discussed and further evidence for metaxenia is briefly presented.

1106. *Tatarinzev, A. S. 634.1:575.127:631.541
(An experiment on vegetative *rapprochement* of the pear and the mountain ash.)
Scientific Fruit Growing. Bull. Lenin Acad. Agric. Sci., Res. Inst. Fruit. Grow. I. V. Michurin 1934 : No. 1 : 16–22.

The method referred to by Michurin as " vegetative *rapprochement* " consists in grafting two parents of distantly related species before attempting to cross them, whereby a marked increase in their power to hybridize results ; it is further essential that the grafts should be made between young hybrid seedlings, which are stated to be more susceptible to such internal influences than mature plants. The crossing moreover must be made at the first time of flowering of the seedlings so treated, later flowerings being quite often unsuccessful. The present investigation has been undertaken in order to give further experimental proof to these views.

The experiments consisted in making grafts of young pear hybrids, hybrids obtained by interspecific crossing and a pure *Pyrus* species respectively on to mountain ash stocks and similar grafts of mountain ash hybrids on to pear stocks. All the grafts were successful and no morphological differences in either stock or scion were observed. The pears grafted on to the rowans developed well, apparently better than on their own roots.

Some of the grafts flowered in 1932 and the preliminary results obtained with these flowers are reported. The flowers of the pear grafts on the rowan, which flowered in 1932, were pollinated by the rowan. The reciprocal crosses were not made because of the difference in time of flowering. The fruits obtained by pollination of the rowan by the pear displayed absolutely no external differences in the form of metaxenia. The percentage set of fruit was no greater in the trees subjected to vegetative rapprochement than in the two others in which this treatment had not been applied. The percentage of fruits reaching full development and maturity on the other hand was twice as great in the tree subjected to rapprochement, in addition to which the average weight per fruit and per seed in this tree was also materially increased. It is undoubtedly premature to draw any positive conclusions from these incomplete observations, especially in view of the lack of certainty as to the generic purity of the experimental trees. Nevertheless the rapprochement is much the most likely factor to have caused the difference. For instance, the differences in the two trees not subjected to rapprochement, with regard to number of mature fruits produced by pollination with the pear can be said to be negligible ; the percentage obtained by pollinating rowan by rowan are considerably higher, with marked differences between trees 5 and 6, whilst the percentage from the tree treated by vegetative rapprochement was clearly different from either, being intermediate between the two. These fruits were intermediate also in weight, whilst their seeds were the heaviest of all, though the difference was not quite significant. More positive results are expected from the observations on the young hybrid seedlings when these come into flower.

The desirability of carrying out similar observations on herbaceous plants is also expressed.

The explanation of the phenomenon is sought in the changed nutritional supply in the grafted plants resulting from the different metabolic nature of the rootstock. It is not improbable that such influences may effect the reproductive organs, and it is known that certain fruit trees have been found to be self-sterile in some localities and self-fertile in others. The conditions of nutrition are also known to effect the fertility of plants. Moreover chromosome aberrations have resulted from grafting between distantly related species and it is not improbable that effects may be produced also in respect of compatibility between style and pollen tube, the growth of the embryo in foreign plasma, etc., etc. These influences may of course be favourable in some cases and unfavourable in others.

The co-operation of other investigators in this line of research is solicited.

1107. Rudloff, C. F., and Schmidt, M. 634.11–2.42–1.521.6:575
Der Erreger des Apfelschorfes, *Venturia inaequalis* (Cooke) Aderh. Grundlagen und Möglichkeiten für seine Bekämpfung auf züchterischen Wege. I. (Sammelreferat). [**The pathogen of apple scab, *V. inaequalis* (Cooke) Aderh. The basis and possibilities for its control by breeding. I. (Survey of literature.).**]
Züchter 1935 : 7 : 30–37.

The life history of the parasite and its relation to the host.

* A full summary of this paper is on file at the Bureau.

1108. RUDLOFF, C. F. and SCHMIDT, M. 634.11–2.42–1.521.6:575
Der Erreger des Apfelschorfes, *Venturia inaequalis* (Cooke) Aderh. Grundlagen und Möglichkeiten für seine Bekämpfung auf züchterischen Wege. II.
[The pathogen of apple scab, *V. inaequalis* (Cooke) Aderh. The basis and possibilities of its control by breeding methods. II.]
Züchter 1935 : **7** : 65–74.

The data available in the literature are reviewed with regard to the biology of the pathogen, the different degrees of susceptibility of apple varieties and species of *Malus* to the fungus, the factors determining the degree of susceptibility, the possibility of the existence of physiological forms of *Venturia inaequalis* and finally the problem of breeding resistant apple varieties.
In this connection, the preliminary knowledge essential to the breeder of scab-resistant apple varieties is discussed.
Between the writing of the above article and its publication the authors have added to the information under review in a paper on the influence of the nutrient medium on the fungus and further in the paper on breeding resistant varieties already summarized (see " Plant Breeding Abstracts," Vol. V, Abst. 779).

1109. 634.15:576.16
WIEGAND, K. M. 576.12
A taxonomist's experience with hybrids in the wild.
Science 1935 : **81** : 161–66.

The circumstantial evidence is put forward for instances of hybridization in the wild in Amelanchiers, asters and *Crataegus*, resulting in the production of forms with all the characteristics of a true taxonomic species. The frequency of hybridization in nature is also discussed and its possible dependence on environmental changes leading to disturbances in the time of flowering of a particular species and consequent pollination by some other species.
The problem of the possible significance of hybridization in the wild as a factor in evolution and the origin of species is considered. Suggestions for the taxonomic treatment of such wild forms are also mentioned.

1110. 634.2:575.127.2:576.312.35
LICHOVITZER, V. G. 634.75:575.127.2:576.312.35
(Notes on the karyotype of fruit trees.)
Scientific Fruit Growing. Bull. Lenin Acad. Agric. Sci., Res. Inst. Fruit Grow. I. V. Michurin 1934 : No. 3 : 39–40.

The repeated attempts of I. V. Michurin to produce a hardy peach for the north have so far proved unsuccessful. Even the " Posrednik " peach-almond hybrid from *Prunus mongolica* Maxim. x *P. Davidiana* has not justified the great expectations founded upon it. New means are being tried and one of the species to which attention is being turned is *P. Besseyi* Bail., which has produced a remarkable number of successful hybrids in crosses with a wide range of species begun in 1934. Root tip examinations were made on *P. Besseyi* and shewed the presence of 16 chromosomes, which is thus the same as the chromosome number of *P. pumila* and the peach.
Root tip counts were made also of *Shepherdia argentea*, now being used for crossing with *Hippophae rhamnoides*, had 22, the same number as *S. canadensis*.
The hybrid between *Fragaria grandiflora* and *F. elatior*, now receiving attention because of its frost resistance, had 44–46 chromosomes in the root tips, the precise number being difficult to ascertain on account of the irregular way in which the chromosomes seemed to be stuck together, but being certainly less than the expected 49. Variations were observed also in the size of the cells and of the nucleoli in this hybrid.

1111. HERRERO EGAÑA, M. and ACERETE, A. 634.3:581.331.2
Morfología del polen en el género *Citrus*. **(The pollen morphology in the genus *Citrus*.)**
Bol. Inst. Investig. Agron. Madrid 1935 : **1** : 11–31.

Observations were made on the pollen of five species, *C. aurantium*, *C. nobilis*, *C. sinensis*, *C. maxima* and *C. limonia*, several varieties of each species being taken. The form, number of

furrows, character of exine and intine, and diameter of the pollen grains are noted. The observations shew that differences in pollen characters are sufficient to distinguish *C. limonia* and the pollen characters of *C. sinensis* are valuable as supplementary diagnostic characters.
A certain amount of correlation was observed between the presence of characters such as coarseness of skin in the fruit and in the pollen.
The conclusion is reached that the pollen characters are valuable aids to the identification of hybrids.

1112. HODGSON, R. W. 634.31:575.252
On bud-selection and water relations of citrus leaves.
Hadar 1934 : **7** : 277–79.
OPPENHEIMER, H. R., OPPENHEIMER, H. CH. and MENDEL, K.
The authors' reply.
Hadar 1934 : **7** : 279–82.
Professor Hodgson objects to certain statements attributed to him in an article published under the above title (see " Plant Breeding Abstracts " Vol. IV, Abst. 884) which he states are misleading or inaccurate and he discusses the possibility of obtaining improved varieties by means of bud mutations involving physiological as well as morphological characters. In the selection of mother trees for budwood trueness to type is, in his opinion, of far greater value than yield performance.
The authors reply that they are in agreement with Professor Hodgson's conclusion and that the article in question was merely informative and was not intended for the solution of the complicated scientific problems involved.

1113. WEBBER, H. J. 634.33–1.541.1:575
Influence of rootstock strains on yield and size of lemon trees.
Proc. Amer. Soc. Hort. Sci. 1934 : **31** : 83–88.
Evidence is rapidly accumulating from citrus experiments, shewing that if the same stionic reaction (i.e. that caused by the mutual influence of stock and scion) is to be obtained regularly, the stocks must all have the same genetic constitution and the scions must be of the same strain and genetically homogeneous. Moreover the experiments described seem to shew that certain strains used as stocks give better results with a given strain of a particular scion variety.

1114. JARRY-DESLOGES, R. 634.42:575
Culture et sélection du *Feijoa Sellowiana* (Berg.). **[Cultivation and selection of *F. Sellowiana* (Berg.).]**
Rev. Bot. Appl. 1935 : **15** : 115–18.
Cultural methods are recommended to improve the yield of fruit where poor. Selection for fertility and other desirable characteristics such as a suitable size of fruit, the minimum sclerotic cells in the flesh and finally the flavour, should, it is believed, yield fruits of the highest quality, since like most sub-tropical fruits *Feijoa* still represents very heterogeneous material and should be capable of marked improvement.

1115. 634.441:581.163:581.162.32:578.08
JULIANO, J. B. 634.441:581.48
Origin of embryos in the strawberry mango.
Philipp. J. Sci. 1934 : **54** : 553–61.
A case of polyembrony in the strawberry mango, an Indian variety, is described. Since all the embryos in the mature seed were found to have arisen from the nucellus and are therefore apogamic in nature, this Indian mango cannot be used as suitable pistillate material in hybridization work. It might, however, perhaps be used as pollinator.
Conditions are stated to be different in the pico mango in which one of the embryos in the mature seed is normally the result of fertilization and which may therefore be utilized to some extent as a pistillate plant in breeding work.

1116. JONES, M. 634.54:575.12(74.8)
J. F. Jones, experimental work in hybridizing filberts and hazels.
Proc. Nth. Nut Gr. Ass. 1933 : 24th Ann. Meeting : 14–16.
More fully treated elsewhere (Cf. " Plant Breeding Abstracts " Vol. V, Abst. 782).

1117. SHIBUYA, T. 634.58:581.162.5:581.466
(Studies on the sterile flowers of peanut.)
J. Soc. Trop. Agric. Formosa 1934 : **6** : 417–24.
In contrast to earlier investigators the author found that his experiments led to the conclusion that, though the flowers were hermaphrodite, 25–30 per cent of the total flowers on the groundnut plants observed were non-functional and atrophied not owing to morphological sterility but to external or internal causes preventing fertilization or the development of the gynophore.
On the other hand, in exceptional cases (3 per cent of the total number) abnormal sterile flowers with styles reaching no further than half way up the inside of the calyx tube were found among the atrophied flowers mentioned and such flowers might be mistaken for staminate forms.

1118. ROBINSON, T. R. 634.653:581.162.3:581.145.1
Setting of fruit—Pollination.
Yearb. Calif. Avocado Ass. 1931 : 107–11.
Observations on the role of the A and B varieties in reproduction in the avocado (Cf. " Plant Breeding Abstracts," Vol. IV, Abst. 247). The disturbing effects of temperature on dichogamy and pollination in certain varieties such as Fuerte and Chota are discussed. These and other varieties are also known to display single instead of double flowering cycles.

1119. 634.7.0014(74.9)
CLARK, J. H. 634.835.0014(74.9)
Some new varieties of small fruits and grapes.
N.J. Hort. Soc. News 1935 : **16** : 700–01, 709.
A report on the behaviour of new varieties of strawberries, raspberries, dewberries, blackberries, currants, gooseberries and grapes tested at the New Jersey Experiment Station where 270 varieties of small fruits were grown in 1934 in addition to seedlings obtained by breeding. Several of the varieties mentioned have already been noted in previous issues of " Plant Breeding Abstracts."

634.711 Potmac(73)
1120. 634.711 Sodus (73)
SLATE, G. L. 634.711–2.8–1.521.6
Home garden raspberries.
Horticulture 1935 : p. 123.
The mosaic resistance of certain varieties of recent origin is mentioned including Newburgh, Chief, Potomac and Sodus. Potomac is a new sort from the United States Department of Agriculture, and Sodus, a purple fruited type, is a cross between the Dundee black raspberry and the Newburgh red raspberry and is regarded as specially promising.

1121. HAHN, G. G. 634.722–2.452–1.521.6
Immunity of Viking, a Norwegian red currant, to *Cronartium ribicola* and *C. occidentale* under greenhouse conditions.
Circ. U.S. Dep. Agric. 1935 : No. 330 : Pp. 16.
The history and botanical description of the Viking currant belonging to the *Ribes petraeum* group is given and special attention is drawn to the distinction between this Norwegian currant and the Red Dutch currant, though the two forms originally possessed the same varietal name. Greenhouse experiments from 1929–32 shewed the Viking to be consistently immune to *Cronartium ribicola* strains as far as the production of fertile or abortive uredinia or telia was concerned. Necrotic flecks did, it is true, form in expanded leaves that were tender and unhardened but fully mature leaves shewed no sign of infection. Field tests begun in 1932 confirmed the results of greenhouse experiments.
Similar immunity to aeciospores of piñon blister rust, *C. occidentale* from *Pinus monophylla* was revealed by innoculation tests in 1931.

1122. 634.771(51)
HALL, C. J. J. VAN 634.771(49.3)
China en Congo. (**China and Congo.**)
Ind. Mercuur. 1933 : Pp. 16.
[Also Ber. No. 77 v.d. Afdeel. Handelsmuseum v.d. Kon. Vereen. Kol. Inst. (Amsterdam : Centrale Boekerij 1933).]
The merits of the Congo and of the dwarf banana (*Musa Cavendishii*) known variously as dwergbacove, Chinese banana, Teneriffe banana, Trinidad Governor or simply " China," as possible resistant substitutes for the Gros Michel are discussed, mainly by reference to the work of Wardlaw and McGuire, and of Tomkins on the Brazilian banana, which appears to be identical with " China."
The opinion of these authors as to the inferiority of Congo is regarded as premature.

1123. OLMO, H. P. 634.835:575.24
Bud mutation in the vinifera grape. I. " Parthenocarpic " Sultanina.
Proc. Amer. Soc. Hort. Sci. 1934 : **31** : 119–21.
From the Sultanina or Thompson's seedless vine which owes its popularity to the absence of mature seeds a mutant form has arisen in which seed development is not even initiated and the berries are apparently formed vegetatively. The mutant vine itself shews vigorous growth and resembles the Sultanina in foliage and stem characters but the berries are few in number, below normal in size and spherical in shape. The pollen though normal in appearance has a viability of only 15 per cent and approximately 3 grains per 1,000 emit pollen tubes. Also the ovules failed to set normal berries when tested with normal pollen and out of 8,000 berries on the mutant vines on the average 3 per cent were found to be " normal," i.e. of the Sultanina type.
The yield in 1934 from the mutant vines was less than a quarter of that obtained from the Sultanina strain. The possibility of improving the yield is mentioned, but the new form is of little or no commercial value.

1124. PIRES, R. B. 634.835.09:575.25
Ensaio de diagnose dum hibrido do genero *Vitis*. (**Experiment on the diagnosis of the hybrid of the genus *Vitis*.**)
Inst. Sup. Agron. Lisboa 1935 : Pp. 23.
A study made of the hybrid Riparia-Rupestris Gigantesque I. After a full review of the literature on the subject the hybrid is described. In leaf characters it resembles *Vitis rupestris*, in the plant itself the characters of *V. riparia* are more evident. In many of the characters the hybrids shews a resemblance to *V. cordifolia* and it is not infrequent to find stems and leaves of intermediate type and mosiacs consisting of the characters of the two parental species and of *V. cordifolia*. This applies both to the external morphology of the plant and to the anatomical features of the organs seen in sections. Some of the characters of *V. aestivalis* also appear in the hybrid. As regards anatomical features the characters of *V. rupestris* are mainly dominant to those of *V. riparia* but many characters of *V. candicans* are also unmistakably present. All these other three species are therefore regarded as having participated in the origin of the hybrid in question in addition to *V. rupestris* and *V. riparia*.

1125. KUZ'MIN, A. JA. 634.836.09(47)
(**Key to the grape varieties produced by I. V. Michurin.**)
Scientific Fruit Growing. Bull. Lenin Acad. Agric. Sci., Res. Inst. Fruit Grow. I. V. Michurin 1934 : No. 3 : 44–48.
Brief descriptions are given of the morphological characteristics of the chief hybrid grape varieties produced by Michurin, with a key for their identification.

1126. WALLISCH, R. 634.972.7:576.312.35
Die Chromosomenverhältnisse bei *Tilia platyphyllos*, *Tilia cordata* and *Tilia argentea*. (**The chromosomal relationships in *T. platyphyllos*, *T. cordata* *T. argentea*.**)
Öst. bot. Z. 1930 : **79** : 97–106.

The observations described were made mainly on pollen mother cell divisions in 1927. The form of the chromosomes and the course of the reduction division are described. For *T. platyphyllos* and *T. argentea* the haploid number 40 was counted and for *T. cordata* 36, but owing to the smallness of the chromosomes and the difficulty of distinguishing individual ones these numbers are regarded as only approximate. In size and form the chromosomes of all three species were alike and no irregularities of meiosis were observed.

1127. SPAETH, J. N. 634.972.7–1.547.1:578.08
A physiological study of dormancy in *Tilia* seed.
Mem. Cornell Agric. Exp. Sta. 1934 : No. 169 : Pp. 78.

A full study of the factors involved in securing prompt and abundant germination of the lime seeds. Various methods of stimulation are discussed.

1128. WHITAKER, T. W. 634.973:576.312.35:575.12
A karyo-systematic study of *Robinia*.
J. Arnold Arbor. 1934 : **15** : 353–57.

The chromosome numbers and the percentage pollen sterility are given for a number of species, embracing all four sections of the genus, and various hybrids. The haploid number 10 was determined for most of the forms examined, which number is also given for *R. pseudoacacia*, though this was determined not in the species itself but in hybrids of it with other species of known chromosome number: these were *R. Holdtii* Beissn. (*R. pseudoacacia* x *R. luxurians*), *R. Slavinii* Rehd. (*R. Kelseyi* x *R. pseudoacacia*) and *R. Margaretta* Ashe (*R. hispida* x *R. pseudoacacia*). The two species *R. hispida* and *R. Boyntonii* are triploids with n = 15 and displayed a high degree both of meiotic irregularity and pollen sterility. No tetraploids are known in *Robinia* and the triploid species are thought to have originated from one of the diploid species, probably *R. fertilis*, with which they shew the greatest resemblance. The hybrid *R. Slavinii* has originated quite recently under cultivation, spontaneously. Its two parents *R. Kelseyi* and *R. pseudoacacia* both have 10 chromosomes and pairing in the hybrid is regular.
The supposed role of *R. hispida* in the parentage of *R. Margaretta* is considered improbable in view of its triploid nature ; the hybrid was meiotically regular and a more probable parentage is thought to be *R. pseudoacacia* x *R. fertilis*.
The equality of chromosome number and regularity of pairing between the species, even of the eastern and western groups, are evidently the causes of the interspecific hybridization so frequently observed in this genus, while the ready vegetative reproduction has further contributed to the preservation of the hybrids when sterility occurred as in the case of the polyploid species and hybrids.

1129. COSTER, C. and EIDMANN, F. E. 634.976.22:575.42(92.2)
Selectie-onderzoek van den djati (*Tectona grandis* L.f.). [**Selection of teak (*T. grandis* L.f.).**]
Tectona 1934 : **27** : Pp. 45.
(Also Korte Meded. Boschw. Buitenz. 1934 : No. 40.)

The paper describes a study in Java of types obtained from the whole range of teak varieties—from Siam, Indo-China, Burma, British India and the Celebes, as well as a number of Java varieties.
Data are given of the climate, soil, etc., of the countries of origin, and literature relating to germination, and growth of seeds from different sources is reviewed.
For the experiment, uniform stretches of land in several different places were chosen after a study of the variation in height of the existing trees. After cleaning, the teak seedlings were planted in blocks of 50 x 50 metres in October and November 1932.

The fruits (" seed ") of the varieties are described, and data shewing the considerable variation in size, weight and germination are tabulated. Germination normally starts 10–20 days after sowing and 80 per cent have germinated in 30–50 days. Burma and Malabar were the best seed. The seedlings were measured in July 1933 and those from Java and Malabar were the tallest. Considerable differences in the appearance of the seedlings, leaf size and shape, etc., are described and illustrated. Malabar shews early branching.

In view of the connexion in some of other crops between high suction pressure of the seed and high yield, hardiness and quick maturity, the suction pressure of the teak seeds was investigated by germination in a series of concentrations of sugar solutions (with 0.05 per cent formalin to ensure a sterile medium and 0.1 per cent sodium bicarbonate to prevent inversion of the sugar, and other necessary precautions). The differences were not marked and the connexion with the first year's growth was not clear.

The oxygen requirements of the root systems were studied by a method previously described of growing potted plants in oxygen-free water. The small differences rather suggest a relationship to the soil types from which the seeds were obtained.

Experiments on the transpiration loss of fresh cut leaves shewed no quantitative differences between the varieties, although the onset of wilting was manifested in the different varieties at different times. L. E. M.

1130. COSTER, C. and HARDJOWASONO, M. S. 634.976.22:575.42(92.2)
Selectieonderzoek van den djati (*Tectona grandis* L.f.) II. De groei gedurende het tweede levensjaar. [**Selection of teak (*T. grandis* L.f.) II. Growth during the second year.**]
Tectona 1935 : **28** : Pp. 19.
(Also Korte Meded. Boschw. Buitenz. 1935 : No. 49.)

Further data are given after two years' growth relating to differences in height, growth, branching, leaf shedding in the dry season, and disease, of the teak varieties previously described at one year.

On the whole, the Java varieties were tallest and thickest and those from Siam and Indo-China had the best trunks. Malabar was shortest, probably owing to its heavy branching and was more liable to attacks of *Corticium salmonicolour*, which might not have occurred with less dense planting.

After measurements in July 1934 the plots were thinned to 2 x 2 metres and basal shoots removed. In some heavily branched plots of Malabar thinning was postponed.

After two years' growth it is concluded that the good Java varieties are as good as the best foreign ones, some of which may be useful in special places where Java teak is liable to wind damage or to heavy branching. L. E. M.

VEGETABLES 635

1131. 635.25:576.312.34
LEVAN, A. 635.25:576.356.2
Cytological studies in *Allium*, VI. The chromosome morphology of some diploid species of *Allium*.
Hereditas, Lund 1935 : **20** : 289–330.

The chromosome morphology at meiosis and mitosis of a large number of diploid species of *Allium* is described and illustrated.

The occurrence of a quadrivalent in *A. ammophilum*, a diploid species, represents the first case of segmental interchange within the *Liliaceae*.

1132. JONES, H. A. and EMSWELLER, S. L. 635.25:581.162.3:578.08
The use of flies as onion pollinators.
Proc. Amer. Soc. Hort. Sci. 1934 : **31** : 160–64.

The method previously described has aroused considerable interest and is now being tested for other crops. The present paper deals with improvements in technique.

1133. JONES, H. A., BAILEY, S. F. and EMSWELLER, S. L. 635.25–2.7–1.521.6:575
Thrips resistance in the onion.
Hilgardia 1934 : **8** : 215–32.
Of a large number of varieties tested only one, White Persian, shewed a satisfactory resistance to thrips combined with other necessary characters.
Certain morphological features of this variety, the shape of the leaves, the angle of divergence of the two innermost leaves and the distance apart of the leaf blades on the sheath column restrict the activity of the thrips population and there are probably other characters by which the plant is able to withstand injury.
Crosses are being made to combine the resistance of White Persian with the qualities of commercial varieties.

1134. SATÔ, D. 635.26:576.354.46
Chiasma studies in plants, I. Chromosome pairing and chiasma behaviour in *Allium Moly*.
Jap. J. Genet. 1934 : **10** : 155–59
The behaviour of the chromosomes during meiosis is figured and described in some detail. A discussion of the results is reserved for a further paper.

1135. ONNO, M. 635.34:576.16
Die Wildformen aus dem Verwandtschaftskreis, "*Brassica oleracea* L." (**The wild forms from the group of related forms, "*B. oleracea* L."**)
Öst bot. Z. 1933 : **82** : 309–34.
Studies have been made of a large number of herbarium wild specimens of the section *Brassica* Presl. Fl. Sic. 1826 from the Mediterranean region many of them being closely allied to some of the cultivated forms included under *B. oleracea*. The forms have been classified and systematic descriptions of them are here given, with indications of their interrelationships in the form of a genealogical tree. Their distribution is also illustrated in a chart.

1136. WALKER, J. C. and BLANK, L. M. 635.34–2.484–1.521.6:575
Fusarium-resistant Danish Ballhead cabbage.
J. Agric. Res. 1934 : **49** : 983–89.
A full account is given of the process of selection and disease resistance tests in the successful production of lines of cabbage of the Danish Ballhead type, homozygous for resistance to *Fusarium conglutinans* Wr. and satisfying the requirements of the commercial standard for the variety.
The principle applied throughout the experiment (begun in 1927) was the elimination of all susceptible or intermediate resistant types and the retention of only those plants carrying the main gene for resistance.
The new strain 3331 B, which was developed from seed of the commercial Danish Ballhead variety is being multiplied for commercial use and will be called Wisconsin Ballhead.

1137. WINGARD, S. A. 635.34–2.484–1.521.6:575
The control of plant diseases through the use of resistant varieties.
Virginia Fruit 1935 : **23**(3) : 29–30.
A popular account with special reference to the achievements of Dr. L. R. Jones and his associates in producing cabbage varieties resistant to yellows (*Fusarium conglutinans*).

1138. 635.41:576.312.32:577.88
HAGA, T. 635.41:576.312.332
Sex and chromosomes in *Spinacia oleracea* L.
Jap. J. Genet. 1935 : **10** : 218–22.
The presence of six equal pairs of chromosomes was demonstrated in the somatic cells of the male plant, in meiosis in the pollen mother cells (at diakinesis, metaphase I and metaphase II) and at diakinesis in the megaspore mother cell. The genetical reults of other workers, on sex ratios and on the progeny of selfed female intersexes indicate that the male plant is heterozygous for sex factors, but no morphological differentiation of chromosomes can be observed.

1139. EMSWELLER, S. L. 635.53:581.143.26:575
Premature seeding in inbred lines of celery.
Proc. Amer. Soc. Hort. Sci. 1934 : **31** : 155–59
From plants of Golden Plume variety and two lines of Golden Self Blanching selections of bolters and non-bolters were made and allowed to self-pollinate. Ultimately inbred lines (which included annuals and biennials) were obtained and these, with one inbred line lent by a seed company, were observed under different conditions of temperature and light during 1931–33.
From the results it is evident (1) that strains of celery can be obtained that will not bolt under conditions producing a high degree of bolting in other strains ; and (2) that lines can be obtained so definitely annual in tendency that they produce some plants with seed stalks even under the most favourable conditions for vegetative growth. Finally in the author's opinion biennials might even behave as annuals under suitable conditions.
A genetic study of bolting is also in progress and so far the evidence tends to shew that non-bolting is a quantitative and recessive character.

1140. 635.546:581.351.2:576.312
COOPER, D. C. 635.546:576.312.35
Microsporogenesis and the development of the male gametes in *Portulaca oleracea*.
Amer. J. Bot. 1935 : **22** : 453–59.
Detailed cytological observations on processes leading to the ultimate formation of two male gametes. Each gamete is a distinct cell consisting of a nucleous embedded in a sheath of cytoplasm clearly outlined by a limiting membrane. Whether this cytoplasm is ultimately included in the zygote at fertilization is to be investigated as a point of genetic interest.
The haploid chromosome number was 27.

1141. MANTON, I. 635.561:576.356.5
The cytological history of watercress (*Nasturtium officinale* R. Br.).
Z. indukt. Abstamm.-u. VererbLehre 1935 : **69** : 132–57.
Three polyploid forms, diploid, triploid and tetraploid with 32, 48 and 64 somatic chromosomes respectively have been recognized within the wild species. All three forms are distributed throughout Europe and the British Isles.
There is a definite morphological similarity between the three forms, best distinguished by their fruits which shew a marked decrease in size ranging from those of the tetraploid which are the largest to those of the sterile triploid. Certain other differences in size of flower and rate of growth which are correlated with low chromosome number could be observed under special conditions.
A study of meiosis shewed that the sterility of the triploid form was due to irregularities during reduction. Meiosis in the fertile tetraploid and diploid forms is regular. No evidence of secondary pairing was found.
All forms are reciprocally interfertile and self-fertile and forms with varying chromosome numbers may arise from the occasional seed setting of triploids—a fact of possible evolutionary significance.
Among a collection of the cultivated forms in use in England, France and Germany no tetraploid forms occurred, the continental forms were without exception diploid, in England diploid and triploid. The probable reasons for this are discussed.

1142. LEACH, J. G. and CURRENCE, T. M. 635.61–2.484–1.521.6:575
Resistance to *Fusarium* wilt in muskmelon.
Phytopathology 1935 : **25** : p. 25. (Abst.)
Among a number of plants of *Cucumis melo* selected for resistance to *Fusarium*, one appeared to be a natural hybrid between Golden Osage and Honeydew and among its progeny were resistant plants of various types. Further studies are being made on self-pollinated selections.

1143. 635.61/3:575.061.1:575.172
SINNOTT, E. W. 635.61/3:575–18:575.172
The genetic control of developmental relationships and its bearing on the theory of gene action.
Science 1935 : **81** : p. 420.

A brief report mentioning the statistical basis of the author's theory that in genic control of developmental relationships such as size, weight and shape in Curcurbits (Cf. "Plant Breeding Abstracts" Vol. III, Absts. 280, 530 and Vol. IV, Abst. 806) it is the relative rather than the absolute growth that is regulated.

The possibility of applying this principle to the genetic expression of all heritable traits is mentioned.

1144. HUTCHINS, A. E. 635.63:581.41:575.11
Morphological relationships in the ontogeny of the cultivated cucumber *Cucumis sativus* L.
Tech. Bull. Minn. Agric. Exp. Sta. 1934 : No. 96 : Pp. 35.

Studies were carried out to determine the degree of association in length and in shape of a number of organs of the cultivated cucumber (*Cucumis sativus* L.) on some 49 varieties and inbred strains, and also on an F_2 population of 300 individuals resulting from a cross between two inbred strains one with very long ("Lochie's Perfection") and one with very short fruits ("Chernobrufzy"). Correlation studies of mean lengths, and in some cases, indices, shewed that the cotyledons, mature leaf, unfertilized ovary, mature fruit, seed, mature internode, height of plant, mature fruit stalk, and mature petiole shewed a high degree of association one with the other, both in the varieties and in the F_2 population. The relationship was present at all stages of growth, and it is suggested that the genes influencing it are not specific for a given organ, but affect, in this respect, the plant as a whole. Taken with some as yet unpublished data the results suggest that at least three independent genes are concerned, which may possibly be shape factors. The length and shape of the seed and cotyledons are influenced more by the female than by the male parent.

It is suggested that the results may be useful in the classification and identification of varieties, and also in plant breeding studies.

1145. FISCHER, A. and SENGBUSCH, R. VON 635.64:581.47:575.11.061.1
Die Züchtung von Tomaten mit nichtplatzenden und druckfesten Früchten. (**The breeding of tomatoes with non-splitting and pressure-resisting fruits.**)
Züchter 1935 : **7** : 57–62.

The examination of an extensive collection of tomato varieties shewed that all varieties with plum-shaped fruits and the variety *Solanum lycopersicum pruniforme*; the varieties "Grosser" and "Kleiner Zwerg"; and the wild form *S. racemigerum*, had fruits whose resistance to splitting was not equalled by any other known varieties. No really satisfactory laboratory method for the determination of resistance to splitting was found.

Crosses of the non-splitting "Kleiner" and "Grosser Zwerg" (dwarf) forms with readily splitting cultivated varieties indicated that the non-splitting of the fruit was conditioned by the abnormal form of growth. It can also be assumed that resistance to splitting is determined by the shape of the fruit.

Selections were made of non-splitting types from the F_2 crosses *S. racemigerum* and different varieties of *S. lycopersicum*. These strains have small fruits and are therefore being crossed with normal-fruited varieties to combine the two desirable characters.

Resistance to pressure is an important character where transport has to be considered. A simple form of apparatus is described which has been devised to measure the degree of resistance. Measurements by this means of an extensive collection of tomato varieties shewed that quite a number of varieties such as Des Alliés, Juwel and Profusion were extraordinarily resistant to pressure, withstanding up to 5 kg. of pressure, in contrast to the most widely distributed

varieties of equal fruit weight, Dänische Export, Tuckswood, Bonner Beste, Lucullus and Westlandia which withstood only 3 kg.
No data are available on the inheritance of resistance to pressure. Although on the whole the types resistant to splitting are the least resistant to pressure there are exceptions to show that it is not a close correlation and there is every possiblility of being able to breed non-splitting types resistant to pressure. A thorough investigation is needed by mechanical methods of the causes of the resistance to pressure.

1146. Down, E. E. 635.651/2:581.162.32:578.08
Bean hybridization.
J. Amer. Soc. Agron. 1935 : **27** : 318–19.
In addition to the ordinary procedure of emasculation and pollination the following points, among others, have been found important in the successful hybridization of beans.
The temperature of the greenhouse at pollinating time should be above 68°F. and below 75°F. and the relative humidity very high. Flowers should be carefully emasculated 1–2 days before the normal time when pollen is shed and pollination, for which a pollen-covered stigma from a flower opened early in the morning is used, should follow immediately.
By such measures pods containing from 2–5 or 6 hybrid beans have been actually obtained in 55–65 per cent of cases.

1147. Daniel, L. 635.652:575.12
Sur un cas de croisement fortuit de haricot. (**A case of chance crossing in the French bean.**)
C. R. Acad. Sci. Paris 1934 : **199** : 1170-72.
In a row of the variety Princesse grown in 1933 in the vicinity of the variety Flageolet, seven seeds were observed, with purplish brown mottling on a pale mauve ground. The plants arising from these seven seeds were all different from the parental line and also differed among themselves in colour, time of maturity, etc. They are evidently hybrids between the two varieties but as these had been constant over a large number of generations the inheritance is claimed to be non-mendelian.

1148. 635.652:575.242:575.116.1:575.172.3
Lamprecht, H. 635.656:575.242:575.116.1:575.172.3
Komplexe und homologe Mutationen, insbesondere bei *Phaseolus vulgaris*, *Ph. multiflorus* und *Pisum sativum*. (**Complex and homologous mutations especially in *Ph. vulgaris*, *Ph. multiflorus* and *P. sativum*.**)
Hereditas, Lund 1935 : **20** : 273–88.
Six mutations, all characterized by entire leaves of the *unifoliata* type, have been found among plants of *Phaseolus* and *Pisum*. Three were found in *Ph. vulgaris*, one of which has already been described (see " Plant Breeding Abstracts," Vol. V, Abst. 826) and the other two are described in the present paper.
A similar type of mutation was found by Rieser 1924 in *Ph. multiflorus* and he cites another case in *Ph. angularis* described by Blakeslee. The sixth case occurred in *P. sativum* (see " Plant Breeding Abstracts," Vol. IV, Absts. 825 and 826).
Two of these mutations were fertile while the remaining four were completely sterile, their floral organs being more or less malformed. Two of the latter had also branched inflorescences.
The gene pair, *Uni-uni*, appears to be homologous at least in the species *Ph. vulgaris*, *Ph. multiflorus* and in *P. sativum*.
The gene pair *Ram-ram* for unbranched-branched inflorescences is also identical in *Ph. vulgaris* and *P. sativum*.
An analysis of the genes for malformed floral organs which leads to complete sterility has not been made but a hypothetical gene pair *Ste-ste* is postulated. A mutation-complex involving therefore two to three homologous gene pairs closely linked is present in these species.
Further investigation is needed to determine whether the mutation-complex is due to inter- or intra-chromosomal behaviour or to other causes.

1149. BRÜNNING, E. 635.652:581.143.26:575.11
Zur Kenntnis der erblichen Tagesperiodizität bei den Primärblättern von *Phaseolus multiflorus*. (**A study of the heritable daily periodicity in the primary leaves of *Ph. multiflorus*.**)
Jb. wiss. Bot. 1935 : **81** : 411-18.

In continuation of the previous study (Cf. " Plant Breeding Abstracts," Vol. III, Abst. 544) selection and selfing of a number of plants up to F_4 shewed that the progeny of a plant subjected to continued self-pollination through several generations exhibits a constant duration of oscillation in its autonomic periodicity.

Reciprocal crosses between plants characterized by a 23 hour and 26 hour oscillation period shewed in F_1 an approximately intermediate length of oscillation period. In the F_2 from seeds obtained from the 23 hour ♀ x 26 hour ♂ cross only, a curve was obtained resembling one which might be regarded as corresponding to that indicating monofactorial segregation ; but no segregation into sharply defined classes could be discerned, and admittedly segregation is not the only possible explanation of the F_2 phenomena.

In view of the technical difficulties any further investigation of the problem must be postponed until some form of suitable experimental material, either botanical or zoological, is found.

1150. STAPP, C. 635.652-2.3-1.521.6
Fortgeführte Untersuchungen über die Resistenzverschiedenheiten von Bohnen (*Phaseolus vulgaris*) gegen *Pseudomonas Medicaginis* var. *phaseolicola* Burkh.
[**Further investigations on the differences in resistance on beans (*Phaseolus vulgaris*) to *Pseudomonas Medicaginis* var. *phaseolicola* Burkh.**]
Angew. Bot. 1935 : **17** : 23-42.

Extensive tests of a large number of varieties have revealed clear differences in susceptibility and also differences between samples of the same variety obtained from different seed merchants.

The results of 261 samples tested are tabulated, of which 36 proved completely resistant. The best variety in this respect is unquestionably Kaiser Wilhelm closely followed by Doppelte holländische Prinzess.

1151. GORPITA, G. 635.655 Dnepopetrovsk
(**New varieties of soya beans for the Ukraine steppes.**)
Semenovodstvo (Seed Growing) 1935 : No. **1** : 52-54.

The varieties at present grown in the Ukraine are unsatisfactory for mechanized harvesting because of the position of their pods, which occur too low on the plant. Two new strains produced by the Ukrainian Breeding Station are promising however, namely Dnepropetrov 0132 and Dnepopetrovsk 069. The first is equal in yield to the best imported types with high pods, is early in maturity and has pods sufficiently high to permit of machine harvesting.

The second is a superior fodder variety.

1152. HENRY, T. 635.655:575
Trabajos de selección biológica en la soja. (**Work on biological selection in soya bean.**)
Arch. Fitotécn. Uruguay 1935 : **1** : 81-91.

In the first place comparative observations have been made on 233 varieties obtained from widely different sources and of widely different types. Only ten of these are promising for Uruguay conditions, where many of the most successful varieties elsewhere have failed entirely. Some of the selected lines have however given extremely high yields. The loss of germination capacity so frequently observed is thought to be attributable to the adverse affects of humidity on the seeds, both at harvest and after sowing. Lines have now been selected however which give a germination of as much as 80 per cent and are at the same time exceedingly tolerant of drought, even at the time of flowering. The best lines have given yields of up to 1,000 kg. per ha., with protein contents of 34-39 per cent and oil contents of 14-20.5 per cent.

1153. 635.655:581.143.26
RUDORF, W. 635.652:581.143.26
Untersuchungen über den Einfluss veränderter Tageslängen auf Sorten von Sojabohnen (*Soja hispida* Moench) und Buschbohnen (*Phaseolus vulgaris* L.). Vorläufige Mitteilung. **[Investigations on the influence of changed length of day on varieties of soya beans (*S. hispida* Moench) and French beans (*P. vulgaris* L.). Preliminary contribution.]**
Z. Zücht. 1935 : A **20** : 251–67.

One of the main obstacles to the cultivation of the soya bean in Germany is the fact that it is a short-day plant and so unsuited to the long-day conditions of the growing season.
It has, however, been found that all varieties of a species do not necessarily shew the same reaction to length of day but many included long-day, short-day or neutral types.
A number of varieties of soya beans which shewed differences in the length of their growing period were grown under short-day conditions to test their reaction to subsequent long-day conditions.
Briefly stated, it was found that there were very considerable variations among the varieties in the amount of shortening of the time taken before flowering and that in general the varieties which under long-day conditions took longest to flower shewed the greatest shortening of their period as the result of short-day treatment.
It is, however, denied that the earliest varieties in general shew the least reaction to short-day conditions and it is still hoped that further researches will reveal the existence of long-day or at least neutral strains of soya beans.
The results are further discussed from a physiological point of view.
Nine varieties of *Phaseolus vulgaris* were similarly tested, among them a number of varieties markedly short-day types, Beste von Allen, Non plus ultra and Englische Gelbe with a less marked short-day reaction, the neutral Reis-Perl and the slightly long-day type Konservanda. It was found that the short-day conditions did not produce so marked an effect as in the soya beans. Further researches are in progress.

1154. HEDRICK, U. P., HALL, F. H., HAWTHORN, L. R. and BERGER, A. 635.656
The vegetables of New York. Vol. 1, Part I. Peas of New York.
Rep. N.Y. St. Agric. Exp. Sta. 1928 : Pp. 132.

635.652
HEDRICK, U. P., TAPLEY, W. T., ESELTINE, G. P. van and ENZIE, W. D.
The vegetables of New York. Vol. 1, Part II. Beans of New York.
Rep. N.Y. St. Agric. Exp. Sta. 1931 : Pp. 110.

Comprehensive accounts of the varieties of peas and beans grown in New York State, their history, systematic botany and descriptions. References, names and synonyms, and a bibliography are given, and there are numerous coloured photographs.

1155. 635.656:575.061.5:581.48
HADFIELD, J. W. and CALDER, R. A. 635.656:575.113.36
A genetic analysis of the seed characters wrinkled, dimpled and smooth in *Pisum*.
J. Agric. Res. 1935 : **25** : 264–77.

In these further studies of *Pisum* (Cf. " Plant Breeding Abstracts," Vol. III, Abst. 583) research on the genetic constitution of the seed forms wrinkled, dimpled and smooth yielded results which were not in accord with those of other workers. The authors found the following formulae adequately explained all results obtained by crossing commercial varieties :—smooth = $l_1l_1l_2l_2RR$; dimpled = $L_1L_1L_2L_2RR$; wrinkled forms = $L_1L_1L_2L_2rr$ and $l_1l_1L_2L_2rr$. Moreover apparently L_1 or L_2 in either the heterozygous or homozygous conditions associated with *RR* results in dimpling and such dimpling is epistatic to smooth.
Data are also presented to shew that dimpling is a character markedly subject to modification which may even be of an extreme degree and that genetically there is no difference between " smooth " (i.e. smooth seeds that are genotypically dimpled) and dimpled seeds arising on dimple-seeded varieties.

The expression of seed forms was found to differ in the stage of plant development at which it occurs ; and allowing for the effects of dominance and epistasis, the wrinkled and smooth characters, if introduced by crossing, affect the appearance of the F_1 seed and segregated by seed on the F_1 plant. Dimpling, on the other hand, if brought in by crossing is not apparent until the F_2 seed has ripened and segregation, which here occurs by plant, is not seen until the F_2 plants are mature.
The epistasis of wrinkled to dimpled were also recorded and the importance of such interaction in masking the direct effect of the factors concerned is made clear in the authors' interpretations of their results.

1156. PESOLA, V. A. 635.656.00.14(47.1)
Peltoherneen jalostuksesta ja sen tuloksista Maatalouskoelaitoksen Kasvinjalostusosastolla. (**On the pea-breeding work of the plant breeding department of the Finnish Agricultural Research Institute and its results.**)
Valt. Maatalousk. Julk. 1935 : No. 66 : Pp. 91.
The results are given of variety tests of a number of varieties of garden and forage peas and of hybrid lines made during a 15 year period, 1919–1934, to select strains of good cooking quality, in the case of garden peas, suitable to the different districts of Finland.

1157. WILSIE, C. P. and TAKAHASHI, M. 635.659:581.162.32
Natural crossing in the pigeonpea.
J. Agric. Res. 1934 : **49** : 923–27.
Three strains of *Cajanus indicus* Spreng. breeding true for the recessive pure yellow flower and self green pod, when planted in alternate rows with strains bearing the dominant red or red-veined yellow flowers and red or black blotched pods, yielded percentages of heterozygotes or natural hybrids ranging from 13·98 to 15·86 in a total population of 24,883 plants. Progenies from 5,201 bagged plants contained only 9 natural hybrids, probably due to faulty technique. Comparison with the results of previous investigators definitely suggests that much more natural crossing occurs when different varieties are grown in adjacent rows.
Since the anthers dehisce a day before the flower opens, any high percentage of natural crossing must, it is thought, be due to either a differential growth rate of pollen from various sources or some inhibiting physiological or morphological factor preventing selfing before the flower opens. The flowering stage at which fertilization normally occurs should be investigated.
Plant isolation or bud protection is necessary to ensure self-fertilization if pure strains are desired.

1158. 635.67–2.3–1.521.6
HAENSELER, C. M. 633.15–2.3–1.521.6
Some varieties of sweet corn resistant to wilt.
N.J. Hort. Soc. News 1935 : **16** : p. 678, 685.
Descriptions of the performance of the variety Golden Sunrise and of the two hybrids, Golden Cross Bantam and Top Cross Bantam shew them to be wilt resistant and desirable types from the standpoint of yield and other characteristics.
A number of other somewhat promising wilt resistant forms is also noted.

1159. LAMBERT, E. B. 635.8–1.557–1.421
Size and arrangement of plots for yield tests with cultivated mushrooms.
J. Agric. Res. 1934 : **48** : 971–80.
A first study by statistical methods of uniformity trials conducted at three centres to determine the best size and arrangement of experimental plots. It is asserted that an experiment should be confined to a single house. Analysis of the limited number of plots considered revealed considerable differences between beds, but not between sections of the same bed. Randomized block designs, with the bed as a block, are therefore held to be feasible. The error was found to be reduced by taking a number of half-sections together, and by taking a plot unit not coinciding with the areas chosen as units in filling the beds. Five or six replications are considered to be necessary. J.W.

5:001

The Wistar Institute style brief. A guide for authors.

Wistar Inst. Press, Philadelphia, 1934 : $2.00. Pp. 170. 23 figs. 37 pls.

A co-operative effort by the editors of the Wistar Institute Journals and other periodicals to improve the " scientific quality of papers and the technique of their preparation for publication " and by using uniform methods to reduce the cost of publication, thus making it possible to increase the amount of material published. *Inter alia* full and clear directions, illustrated by examples, are given on the preparation of the manuscript, references to literature, proofs and illustrations.

CRESCINI, F. 575:633

Lezioni di genetica vegetale applicata all'agricoltura. (**The principles of plant genetics applied to agriculture.**)

Nicola Zanichelli, Bologna 1935 : Lire 30. Pp. 294. Illus.

The present volume represents a series of lectures given at the R. Instituto Superiore Agrario of Bologna during the academic years 1932–33 and 1933–34. Part I deals with the fundamental principles of plant genetics. Part II is concerned with a brief review of the application of these principles to the improvement of some of the main types of crop plants, the cereals, sugar beet, hemp, flax, tobacco, hop, *Ricinus*, the *Leguminoseae* and pasture plants.

575.1

FASTEN, N. 575.191

Principles of genetics and eugenics. A study of heredity and variation in plants, animals and man.

Ginn & Company, Boston and London, 1935 : $2.80. Pp. viii + 407. 120 figs.

After emphasizing the significance of heredity both in sociology and in branches of industry such as agriculture, and correcting some popular misapprehensions on inheritance, the author reviews the earlier theories of heredity, passing then to the facts of chromosome reproduction and of inheritance. Only then are Mendel's laws presented, followed by some of the more recent developments of Mendelian theory and of the theory of evolution.

The principles of eugenics are treated somewhat at length and the book terminates with an extensive glossary of terms, a bibliography of 213 titles and an index.

582.001

International rules of botanical nomenclature adopted by the International Botanical Congresses of Vienna, 1905, Brussels, 1910 and Cambridge, 1930.

Gustav Fischer, Jena 1935 : 3rd Ed. RM. 7. Pp. xi + 151.

The new rules, published in English, French, and German, have involved many alterations and rearrangements in the previous code of nomenclature. Among the additions and elaborations are a section on the methods of type nomenclature, articles bearing on later homonyms and the introduction and definition of legitimate and illegitimate names or epithets.

The sections dealing with the names of hybrids and half-breeds and of plants of horticultural origin and with orthography should be of special interest to the plant breeder.

63(058)

International agricultural directory.

Wm. Grant Wilson, Cambridge, Mass., 1934 : $1. Pp. 803–96.

A valuable handbook giving lists of the agricultural institutions, Ministries, schools and similar bodies in 121 different countries, including very full data on the U.S.S.R. The publishers are to be congratulated.

BONFIGLIOLI, O. 633(45)
Piante industriali. (**Economic plants.**)
Opera Nazionale Combattenti, Roma 1934 : Lire 17. Pp. 433. 139 figs.
A compact and systematically planned handbook containing observations on the production and importance of economic plants in Italy and a discussion of the culture of the following plants :—hemp, sugar beet, tobacco, tomato, flax, cotton, castor oil plant, etc. For most crops a brief botanical note, advice on climatic requirements, diseases or pests, harvesting and seed production are given. Hemp, sugar beet, tomatoes and tobacco (including curing) are treated relatively fully.
The book should be of use to Italian agriculturists.

LEGENDRE, R. 633.1
Les céréales. (**The cereals.**)
Armand Colin, Paris, 1935 : Collection No. 177 : 10.50 fr. Pp. 218 : 33 figs.
The cereals, which are treated throughout as a group, are dealt with in a general way from a biological standpoint in the first part of this small volume. The second part deals with the importance of cereals and the statistics of their production and the third part is devoted to the technical aspects of their preservation.

633.1/2(73)
HITCHCOCK, A. S. 585.421(73)
Manual of the grasses of the United States.
Misc. Publ. U.S. Dep. Agric. 1935 : No. 200 . Pp. 1040. 1696 figs. $1.75.
A comprehensive account of the grasses of the U.S.A. A botanical description and a brief account with illustrations of each species is given, the States in which it occurs being shown diagrammatically on a small map. There is a key to the tribes, genera and species, pages 772–979 are occupied with synonyms and the rest of the book is devoted to unidentified names, a list of people after whom grasses have been named, a glossary and index.
A useful reference work.

BOIS, D. 633.8
Encyclopédie Biologique, VII. Les plantes alimentaires chez tous les peuples et à travers les ages. Histoire, utilisation, culture. Vol. III. Plantes à épices, à aromates, à condiments. (**Biological Encyclopedia. VII. Alimentary plants of all peoples and throughout the ages. History, use, cultivation. Vol. III. Aromatic plants and plants yielding spices and condiments**).
Paul Lechevalier, Paris 1934 : 50 fr. Pp. iii + 289. 71 figs.
A botanical description of the plants is given together with their history and uses.

BUNTING, B., GEORGI, C. D. V. and MILSUM, J. N. 633.855.34(91)
The oil palm in Malaya. Malayan Planting Manual No. 1.
Publ. by Dept. Agric., S.S. & F.M.S. Kuala Lumpur 1934 : $2. Pp. ix + 293.
35 pls. 31 tables.
The progress made of late in the extension of the oil palm industry and in the knowledge relating to its problems has led to the publication of a new and enlarged edition of Special Bulletin No. 39, now issued by the Department of Agriculture as No. 1 of a new series of Malayan Planting Manuals to serve as a standard work of reference for planters and others concerned with the industry.
Among the problems dealt with which are of interest to the plant breeder are the varieties of *Elaeis guineensis*, germination of the seed, artificial pollination and seed selection.

HOFFMANN, W. 633.859
Die Kultur des Ylang-Ylang- oder Kanangabaumes (*Cananga odorata* Hook F.) und die Verwertung seiner Produkte. [**The cultivation of ylang-ylang or Cananga tree** (*C. odorata* Hook F.) **and the value of its products.**]
Tropenverlag Fr. W. Thaden, Hamburg, Tropische Duftpflanzen No. 1 : 1934 : M. 2.80. Pp. 42. 8 illus.

The history, botany, distribution and cultivation of the tree is briefly described and an account given of the harvesting and distillation of the flowers for their essential oil.

WHEELWRIGHT, E. G. 633.88
The physick garden. Medicinal plants and their history.
Jonathan Cape, London, 1934 : 10s. 6d. Pp. 288. Illus.

The book before us is ambitious in the variety of subjects with which it deals, and consequently much of the subject matter is of a very sketchy nature. The first half deals with the origin and development of medicine in relation to medicinal plants from the Medicine Man of Neolithic times to the early European and English herbalists. The uses of medicinal plants in ancient China, Mesopotamia, India, Greece, Rome and Anglo-Saxon England are described, and a general account is given of the flourishing period of herbals and herbalists in the sixteenth and seventeenth centuries.

Chapter VII is devoted to a brief survey of the medicinal plants of the British flora. The plants are listed in natural orders and their medicinal properties are mentioned.

There are three interesting chapters on " Trade in Medicinal Herbs : " " Cultivation in England : " and " The Drugs of the British Commonwealth," of especial value to the agricultural or economic botanist, and the book concludes with the sketchiest treatment of the living cell and its contents, which hardly does justice to the subject.

There are many spelling mistakes in the botanical nomenclature, and also inaccuracies in the use of technical terms and general descriptions, and the author would have done well to pay more attention to such matters in a book of this kind.

G. D. H. B.

*MICHURIN, I. V. 634:575.127
(**Results of half a century's work on producing new varieties of fruit trees.**)
State Agric. and Co-operative Farm Press, Moscow, Leningrad 1932 : **2** : Pp. 168.

The Soviet fruit breeders are still faced with the problem of extending the cultivation of fruit trees northward and into new areas and of producing forms of southern fruits sufficiently hardy to withstand the rigour of northern conditions. In the eighties of last century I. V. Michurin began this work and has continued it ever since, largely on the lines of hybridization between the tender, high quality forms and the hardy, wild or semi-wild forms from the north or from other cold regions. The present volume is devoted principally to a description of his successful new forms, with indications for each one of its parentage and mode of origin. Descriptions on these lines are given of the new varieties of sour and sweet cherries, plums, greengages and apricots. In a supplement the very recent new varieties of almonds, apples, pears, quince and mountain ash are similarly described. Particular attention is given in the descriptions to the quality of the fruit and the winterhardiness of the varieties. In addition to the large number of new fruit hybrids, all representing an improvement in some respect or other and all characterized by increased frost resistance, descriptions are also given of a number of hardy rootstocks produced in a similar way by hybridization from wild species from cold, often mountainous, regions. In this respect the hardy quince for pear grafts is of especial interest : it will extend pear cultivation considerably towards the north and its fruits are also useful for preserving.

Particular interest is also attached to the rowan hybrids, which bring this tree for the first time

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***An abridged translation of this paper is on file at the Bureau.**

into the realm of economic fruit production. The bitter rowan *Sorbus aucuparia* L. was crossed in 1905 with the German rowan *S. melanocarpa* Neyonhold., which is characterized by edible sweetish flavoured berries. The hybrid " Liqueur " proved entirely frost-resistant and bore black, sweet fruits suitable for preserving and for making excellent liqueurs. Other interspecific *Sorbus* hybrids are promising in their combination of frost resistance and fruit quality and size, and other hybrids of *Sorbus* with *Crataegus* and with *Mespilus* are also mentioned as being of great promise.

A curious pear is described which in addition to two crops a year of ordinary fruit produces a third crop of enlarged leaf petioles indistinguishable in quality from the generatively formed fruit. The author enlarges to a certain extent on his principle of the " mentor," the essential feature of which is that young seedlings of newly formed hybrids are immensely more susceptible to the influence of the stock than old established species and are even capable of being influenced in their hereditary constitution.

The volume is profusely and well illustrated and is a remarkable tribute to the unceasing diligence of I. V. Michurin in his search for new fruit forms and new ways of producing them.

HAWLEY, R. C. 634.9(73)

The practice of silviculture. With particular reference to its application in the United States of America.

John Wiley & Sons, Inc., New York, (Chapman & Hall, Ltd. London) 1935 : 20*s*. Pp. xv + 340. 68 figs.

The third edition of this text-book, rewritten and reset, deals with the practice of silviculture in the U.S.A. on general lines, the reader being referred to other works for details about the separate tree species. The various methods of high forest and coppice reproduction, classified and logically related to each other, are described and illustrated with very clear diagrams, their respective advantages, disadvantages and applications being enumerated. The work of maintaining and protecting forests is also treated, with a large section devoted to forest fires. The style throughout is straightforward, terse, and at times not without a certain dry humour.

A short bibliography is given at the end of each chapter and the book ends with an index.

DEEN, J. L. AND BENSON, A. B. 634.94(014)

A Swedish-English vocabulary for foresters.

Bull. Yale Univ. Sch. For. 1935 : No. 40 : Pp. 83.

Compiled for workers requiring a translation of the more common technical terms used in Swedish forestry, this reference book should prove useful to workers in English speaking countries. For the convenience of those wishing to consult the older Swedish literature a number of expressions which are marked as antiquated or obsolete has been included. Botanical and Zoological Latin equivalents have been given and a list of abbreviations including various weights and measurements pertaining to forestry is appended.

634.95(017)

Bibliographie für Forstwirtschaft mit de Signatur 634.9F nach den Grundsätzen des Melvil Dewey'schen Systems, bezw. der internationalen Dezimalklassifikation. (**Bibliography for forestry with the main number 634.9F according to the principles of the Melvil Dewey system or the international decimal classification.**)

Mitt. schweiz. Anst. forstl. Versuchsw. 1934 : **18**(2) : Pp. viii + 115.

This bibliographical classification is the result of many years of collaboration between forestry experts representing various countries throughout the world and the preliminary step to the compilation of an international bibliography of forestry.

Full descriptions are given of the system of classification and its use and the method of recasting existing classifications on the decimal basis.

The classification, which covers the various aspects of forestry, is accompanied by an index of geographical numbers which can be used for the simultaneous compilation of a geographically arranged catalogue and is completed by an alphabetical word key to the various numbers used in the subject index.

OHNESORGE, M. 635.34(43)
Kopfkohl—Anbau und Markt. **(Headed cabbage—its cultivation and marketing).**
Paul Parey, Berlin 1934 : RM. 8.60. Pp. 81. 35 illus. (Ber. ü. Landw. N.F. 101 Sonderheft).

This publication, written from the economic standpoint, deals fully with the production and the supply and demand for headed cabbages of various kinds and especially cabbage for winter storage.

BOWDIDGE, E. 635.655
The soya bean. Its history, cultivation (in England) and uses.
Oxford University Press, London, 1935 : 6*s.* 0*d.* Pp. xii + 83. 18 pls.

The year 1907 saw the first shipments from the East of the Oriental staff of life, the soya bean, since which time this invaluable legume, the wonder-plant of Nature, has steadily gained in popularity and in the number of its many uses. Not, however, to the extent that its remarkable properties deserve, and Miss Bowdidge in the small book before us is attempting to make the value of the plant better known to the farming public. Addressed to British farmers, the book contains much information which will be of value to readers in all countries, though it will have a particular interest for the English public in presenting a first hand account of the first successful attempt to grow the soya bean on a field scale in this country. As in so many similar cases, the success of the experiment was found to rest on the question of variety, being attained only with the extremely early-maturing varieties selected and acclimatized during a period of years by Mr. J. L. North, late Curator of the Royal Botanic Society of London. The experiment described in these pages is a tribute to the foresight of Mr. North and of Mr. Henry Ford, who grew the beans on his estate at Boreham, Essex, and we sincerely hope that the book and the experiment will be a landmark in the history of British agriculture and initiate a widespread campaign for the cultivation in England of this incomparable legume.

NEW JOURNALS

Archivo Fitotécnico del Uruguay

Under this title the Institute Fitotécnico y Semillero Nacional " La Estanzuela," the national research centre in Agronomy for Uruguay has published the first number of its new official organ.

The genetics of economic plants is the subject of the first article, by the Director, Dr. Albert Boerger and a further article in this is devoted to the breeding of soya beans. There is also a chronological list of the articles published from " La Estanzuela," together with a number of more general articles. In his introduction the Director states the objects of the journal, mentioning that special attention will be given to plant genetics, and that the editors are open to accept articles from foreign contributors.

The articles are in Spanish but have summaries in English or German.

Blumea

The publication long familiar to botanists as the " Mededeelingen van 's Rijksherbarium, Leiden," which started in 1910, has now been converted into a regular journal under the name *Blumea*, after Prof. C. L. Blume, a former director of the Rijksherbarium. The scope of the journal has been somewhat enlarged on account of a closer co-operation with the Herbarium of the Botanical Garden at Buitenzorg. This has resulted in greater attention being paid to the problems of the Dutch East Indies and the Malay Archipelago in general.

The journal is devoted to plant taxonomy and plant geography and the first number, containing pages 1–240 appeared in September 1934. In this there appears an article on " the species conception in relation to taxonomy and genetics " by W. A. Goddijn, from which it will be seen that the journal is not without interest also for geneticists.

Boletin del Instituto de Investigaciones Agronômicas

The *Instituto de Investigaciones Agronómicas* in Spain, consisting of various sections devoted to different branches of agricultural science, was inaugurated in 1932. The first number of the organ of the Institute (*Boletín del Instituto de Investigaciones Agronómicas*) appeared in January, 1935, and future numbers are expected to appear at regular intervals. The Bulletin is well presented and the subject matter is arranged in sections, the articles being furnished with French or English summaries. The orange and fruit section of the first number contains an article on the pollen morphology in the genus *Citrus*. The Institute is to be congratulated on its new venture.

The Journal of the Australian Institute of Agricultural Science.

On 17th January, 1935, the Australian Institute of Agricultural Science was established, with Professor A. E. V. Richardson as President. The object of the new Institute is to promote the advancement of agricultural science in Australia on a commonwealth rather than a provincial basis.

The journal of the Institute is to be published quarterly and the first issue, appearing in March, 1935, contains short articles on a variety of agricultural subjects, included jottings from a tour of agricultural research stations in the Soviet Union, notes on " Scientific Method in the Study of Biology " and on some vernalization experiments with wheat carried out in Australia.

The subscription to the journal is 10*s*. 6*d*. per volume post free.

ERRATUM.

In " Plant Breeding Abstracts, Vol. V, No. 3, Abst. 612, line 6, for "rye" read "wheat."

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by PERCY LUND, HUMPHRIES & CO. LTD.

(12246) Wt. P.377/205/14697. 50. 7/44. P.L.H. & CO. LTD. G.943.